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ABSTRACTS

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ABBREVIATED TITLES USED IN THE ABSTRACTS

Abbreviated Title.	*Journal.*
A.S.T.M. Bull.	Bulletin of the American Society for Testing Materials.
Aero. Engng Review	Aeronautical Engineering Review.
Aeroplane	Aeroplane.
Airc. Engng	Aircraft Engineering.
Airc. Prod.	Aircraft Production.
Airc. Prod. Analyst.	Aircraft Production Analyst.
Amer. Dyestuff Rept.	American Dyestuff Reporter.
Anal. Chem.	Analytical Chemistry.
Annals appl. Biology	Annals of Applied Biology.
Ann. des Mines et des Carburants	Annales des Mines et des Carburants.
Ann. Min. Belg.	Annales des Mines de Belgique.
Ann. Min. Roumanie	Annales des Mines de Roumanie.
Ann. Off. Combust. liq.	Annales de l'Office National des Combustibles Liquides.
Asph. u. Teer	Asphalt und Teer.
Auto Engr.	Automobile Engineer
Auto. Ind.	Automotive Industries.
Auto. Tech. Z. (Berlin)	Automobiltechnische Zeitschrift (Berlin).
Azerb. neft. Khoz.	Azerbaidzhanskoe Neftyanoe Khozyaistvo.
Beitr. angew. Geophys.	Beitrage angewandte Geophysik.
Beitr. Geophys.	Beitrage zur Geophysik.
Bitumen	Bitumen.
Bol. del Inst. Sudamericano del Petroleo	Boletin del Instituto Sudamericano del Petroleo.
Bol. Geol. y Min. (Caracas)	Boletin de Geologia y Mineria (Caracas).
Bol. Inform. Petroleras (B.A.)	Boletin de Informaciones Petroleras (Buenos Aires).
Boll. Soc. geol. ital.	Bolletin de la Societa Geologica Italiana.
B.P.	British Patent.
Brit. Med. J.	British Medical Journal.
Brit. Plastics	British Plastics.
Bull. Acad. Sci. (U.S.S.R. Inst. Seismol.)	Bulletin of the Academy of Sciences (U.S.S.R. Institute of Seismology).
Bull. Amer. Ass. Petrol. Geol.	Bulletin of the American Association of Petroleum Geologists.
Bull. Amer. geol. Soc.	Bulletin of the American Geological Society.
Bull. Ass. franç. Tech. Pétrol.	Bulletin de l'Association Français des Techniciens du Pétrole.
Bull. Inst. Min. & Met.	Bulletin of the Institute of Mining and Metallurgy.
Bull. Inst. Min. (metall.) Engrs.	Bulletin of the American Institute of Mining and Metallurgical Engineers.
Bull. Math. Phys. Éc. polyt. Bucharest	Bulletin de Mathematique et de Physique, Bucharest (École-polytechnique).
Bull. roum. geol. Soc.	Bulletin of the Roumanian Geological Society.
Bull. seismol. Soc. Amer.	Bulletin of the Seismological Society of America.
Bull. Soc. des Naturalistes de Moscou	Bulletin de Societé des Naturalistes de Moscou.
Bull. Univ. Texas (Bur. econ. Geol. Techn.)	Bulletin of the University of Texas (Bureau of Economic Geology and Technology).
Bur. Stand. J. Res., Wash.	United States Bureau of Standards Journal of Research, Washington.
Calif. Oil World	California Oil World.
Canad. Chem. & Proc. Industr.	Canadian Chemical and Process Industries.
Canad. J. Res.	Canadian Journal of Research.
Canad. Min. J.	Canadian Mining Journal.
Canad. Min. metall. Bull.	Bulletin of the Canadian Institute of Mining and Metallurgy.
Chem. & Ind.	Chemistry and Industry.
Chem. Engng	Chemical Engineering.
Chem. Eng. News	Chemical and Engineering News.
Chem. Engng Prog.	Chemical Engineering Progress.
Chem. Ind.	Chemical Industries.
Chem. Met. Engng.	Chemical and Metallurgical Engineering.

Abbreviated Title.	*Journal.*
Chem. Prod.	Chemical Products.
Chem. Rev.	Chemical Reviews.
Chem. Tr. J.	Chemical Trade Journal.
Chem. Wkbld.	Chemische Weekblad.
Chim. Anal.	Chimie Analytique.
Chim. e Industria	La Chimica e l'Industria.
Chim. et Ind.	Chimie et Industrie.
Coke and Gas	Coke and Gas.
C.R. Acad. Sci. (Paris)	Comptes Rendus hebdomadaires des Seances de l'Academie des Sciences (Paris).
C.R. (Doklady) Acad. Sci. U.S.S.R.	Comptes Rendus (Doklady) de l'Academie des Sciences U.S.S.R.
C.R. Geol. Pétr. (Strasboury)	Compte-Rendu des Seances du Groupe des Geologues Pétroliers de Strasbourg.
Diesel Eng. Us. Ass.	Diesel Engine Users Association.
Diesel Pwr. Diesel Transportation	Diesel Power and Diesel Transportation.
Direccion Minas y Geol.	Publication of Direccion Minas y Geologicas (Argentine).
Econ. Geol.	Economic Geology.
Electr. Times	Electrical Times.
Energie	Energie (France).
Engineer	Engineer.
Engineering	Engineering.
Flight	Flight.
Fuel	Fuel in Science and Practice.
Fuel Oil & Oil Heat	Fuel Oil and Oil Heat.
Gas Oil Pwr.	Gas and Oil Power.
Geol. Mag. (Lond.)	Geological Magazine (London).
Geophys.	Geophysics.
Glückauf	Glückauf.
Groz. Neft.	Groznenskii Neftyanik.
Heating Ventilating Engr	Heating and Ventilating Engineer and Journal of Air Conditioning.
India Rubber J.	India Rubber Journal.
India Rubber World	India Rubber World.
Ind. Min. (Argentina)	Industria Minera (Argentina).
Industr. Chem.	Industrial Chemist.
Industr. Engng Chem.	Industrial and Engineering Chemistry.
Industr. Engng Chem. Anal.	Industrial and Engineering Chemistry, Analytical Edition.
Industr. Pwr & Fuel Econ.	Industrial Power and The Fuel Economist.
Inf. y Mem. Ing. (Peru)	Informaciones y Memorias de la Sociedad de Ingenieros del Peru.
Ingenieur	De Ingenieur.
Instrum. Prac.	Instrument Practice.
Instruments	Instruments.
I.P. Review	Institute of Petroleum Review.
J. Aero. Sci.	Journal of Aeronautical Sciences.
J. Amer. chem. Soc.	Journal of the American Chemical Society.
J. appl. Chem. (U.S.S.R.)	Journal of Applied Chemistry, U.S.S.R.
J. appl. Mech.	Journal of Applied Mechanics.
J. appl. Phys.	Journal of Applied Physics.
J. chem. Education	Journal of Chemical Education.
J. chem., metall. min. Soc. S. Africa	Journal of the Chemical, Metallurgical and Mining Society of South Africa.
J. Chem. Phys.	Journal of Chemical Physics.
J. chem. Soc.	Journal of the Chemical Society.
J. Coll. Sci.	Journal of Colloidal Science.
J. Council for Sci. & Ind. Res. (Australia)	Journal of the Council for Scientific and Industrial Research, Australia.
J. Econ. Ent.	Journal of Economic Entomology.
J. Geol.	Journal of Geology.
J. Inst. Fuel	Journal of the Institute of Fuel.
J. Instn. auto. Engrs	Journal of the Institution of Automobile Engineers.
J. Inst. Metals	Journal of the Institute of Metals.
J. Inst. Petrol.	Journal of the Institute of Petroleum.

Abbreviated Title.	*Journal.*
J. Iron & Steel Inst.	Journal of the Iron and Steel Institute.
J. Oil Col. Chem. Assoc.	Journal of the Oil & Colour Chemists.
J. org. Chem.	Journal of Organic Chemistry.
J. Phys. & Colloid Chem.	Journal of Physical and Colloidal Chemistry.
J. phys. Chem.	Journal of Physical Chemistry.
J. R. aero. Soc.	Journal of the Royal Aeronautical Society.
J. Roy. Soc. Arts	Journal of the Royal Society of Arts.
J. sci. Instrum.	Journal of Scientific Instruments.
J. Soc. aut. Engrs	Journal of the Society of Automotive Engineers.
J. Soc. chem. Ind.	Journal of the Society of Chemical Industry.
J. Soc. Dyers Colourists	Journal of the Society of Dyers and Colourists.
J. Western Soc. Engrs	Journal of Western Society of Engineers.
Khim. Tverd. Topliva	Khimiya Tverdovo Topliva.
Lubr. Engng	Lubrication Engineering.
Matières grasses	Matières Grasses.
Mech. World	Mechanical World.
Min. & Metall.	Mining and Metallurgy.
Min. Mag. (Lond.)	Mining Magazine (London).
Mod. Plastics	Modern Plastics.
Monit. Petr. roum.	Moniteur du Pétrole Roumain.
Montan. Rdsch.	Montanistische Rundschau.
Motor Ship	Motor Ship.
N.G.A.A.	Natural Gasoline Association of America.
Nafta	Nafta.
Nat. Petrol. News	National Petroleum News.
Nat. Petrol. News, Tech. Sect.	National Petroleum News, Technical Section.
Nature	Nature.
Neft. Khoz.	Neftyanoe Khozyaistvo.
Nickel Ind.	Nickel Industry.
Nov. Neft.	Novosti Neftepererabotki.
Nov. Tekhn. Bur.	Novosti Tekhniki Bureniya.
Nov. Tekhn. Neft.	Novosti Tekhniki Neftedobvicki.
Oel u.Kohle	Oel und Kohle vereinigt mit Erdoel und Teer.
Oil Engine & Gas Turbine	Oil Engine and Gas Turbine.
Oil Gas J.	Oil and Gas Journal.
Oil Wkly	Oil Weekly.
Ole, Fette, Wachse	Ole, Fette, Wachse, Seife, Kosmetik.
Olii min.	Olii Minerali.
Paint Mnfr.	Paint Manufacture.
Paint Technol.	Paint Technology.
Petroleum	Petroleum.
Petrol. Engr	Petroleum Engineer.
Petrol. Press Service	Petroleum Press Service.
Petrol. Process.	Petroleum Processing.
Petrol. Tech. (A.I.M.M.E.)	Petroleum Technology (American Institute of Mining and Metallurgical Engineers).
Petrol. Times	Petroleum Times.
Petrol. World	Petroleum World.
Phil. Mag.	Philosophical Magazine.
Physics	Physics.
Pipe Line News	Pipe Line News.
Proc. Amer. Petrol. Inst.	Proceedings of the American Petroleum Institute.
Proc. Amer. Soc. Test. Mater.	Proceedings of the American Society for Testing Materials.
Proc. Ass. Asph. Pav. Technol.	Proceedings of the Association of Asphalt Paving Technologists.
Proc. Instn mech. Engrs	Proceedings of the Institution of Mechanical Engineers.
Proc. phys. Soc. (Lond.)	Proceedings of the Physical Society (London).
Proc. roy. Soc.	Proceedings of the Royal Society.
Producers' Monthly	Producers' Monthly.
Przeg. Chem.	Przeglad Chemiczny.
Przem. Naft.	Przemysl Naftowy.
Public Roads	Public Roads.
Quart. J. geol. Soc. Lond.	Quarterly Journal of the Geological Society of London.
Rds & Rd Constr.	Roads and Road Construction.

Abbreviated Title.	*Journal.*
Rds and Streets	Roads and Streets.
Rec. Trav. chim. Pays-Bas	Receuil des Travaux Chimiques des Pays-Bas.
Refiner	Petroleum Refiner.
Rev. Comb. liq.	Revue des Combustibles Liquides.
Rev. Inst. franç. Petrole	Revue de L'Institut Français du Pétrole et Annales des Combustibles Liquides.
Rev. Mod. Phys.	Review of Modern Physics.
Rev. sci. Instrum.	Review of Scientific Instruments.
Ricerca Scientifica e Reconstruzione	Ricerca Scientifica e Reconstruzione.
Riv. ital. Petrol.	La Rivista Italiana del Petroleo.
Roy. Engrs J.	Royal Engineers Journal.
S. Afr. Min. (Engng) J.	South African Mining and Engineering Journal.
Schweiz Arch. Ang. Wiss. Tech.	Schweizer Archiv für Angewandte Wissenschaft und Technik.
Science	Science.
Soap	Soap.
Strade	Strade.
Sulz. tech. Rev.	Sulzer Technical Review.
Summ. Ops, Calif. Oil Flds	Summary of Operations, Californian Oil Fields.
Tech. Phys. U.S.S.R.	Technical Physics of the U.S.S.R.
Tekn. Tidskr.	Teknisk Tidskrift.
Terr. Magn.	Terrestrial Magnetism.
Times Rev. Ind.	Times Review of Industry.
Times Trade & Engr.	Times Trade & Engineering Supplement.
Trans. Amer. Inst. Min. & Metall.	Transactions of the American Institute of Mining and Metallurgy.
Trans. Amer. geophys. Un.	Transactions of the American Geophysical Union.
Trans. Amer. Inst. chem. Engrs	Transactions of the American Institute of Chemical Engineers.
Trans. Amer. Soc. mech. Engrs	Transactions of the American Society of Mechanical Engineers.
Trans. Faraday Soc.	Transactions of the Faraday Society.
Trans. Inst. mar. Engrs	Transactions of the Institute of Marine Engineers.
Trans. Instn min. Engrs	Transactions of the Institution of Mining Engineers.
U.S. Bur. Mines, Inf. Circ.	United States Bureau of Mines, Information Circular.
U.S. Bur. Mines, Rep. Invest.	United States Bureau of Mines, Report of Investigations.
U.S. Bur. Mines, Tech. Paper	United States Bureau of Mines, Technical Paper.
U.S. Geol. Surv. Bull.	United States Geological Survey Bulletin.
U.S.P.	United States Patent.
World Oil	World Oil.
World Petrol.	World Petroleum.
Z. dtsch. geol. Ges.	Zeitschrift der Deutschen Geologischen Gesellschaft.
Z. Geophys.	Zeitschrift für Geophysik.
Z. prakt. Geol.	Zeitschrift zur Praktische Geologie.
Z. ver. dtsch. Chem.	Zeitschrift Vereins deutscher Chemiker.

(Certain periodicals listed above have not been available during 1948.)

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OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

1. Scientific Problems of the Petroleum Industries. Part 1. Prospecting and Production. L. Jacque. *Energie*, Oct. 1947, **31** (39), 235.—A comprehensive review, historical, economic and technical, of the field of oil exploration and methods of production.

D. H. McL.

2. Newer Techniques in Aerial Surveying. S. A. Wengerd. *World Oil*, 15.9.47, **127** (3), 37.—Aerial photography gives speedy coverage, accuracy, continuous reference, and accessibility to all types of terrain, but it cannot completely replace ground surveying and detailed geological work in difficult areas.

The accuracy of maps constructed from aerial photographs with optimum field control is greater than plane-table surveying under any set of conditions and specifications. The technique of photographic flying has been greatly improved in recent years and the same is true of the methods of processing the photographs. There have been improvements in methods of map construction.

Aircraft and cameras suitable for aerial photographic work are briefly described. An outstanding development was the trimetrogon camera, which at 20,000 ft permits flight lines to be 20 miles apart, and can be used to give maps on a scale of 1 : 500,000 or 1 : 100,000. Continuous strip photograph has also been employed. Flight specifications are discussed.

Three types of photographic laboratories were thoroughly tested under a variety of conditions during the war. Film driers can handle 10 ft/min, and a continuous printer can deal with 40 ft/min. Flight checking has been greatly improved. The astrolabe and the equiangulator and zenith camera speed up ground control work. Balloon and flare triangulation has been employed. The land odograph may be of use in low relief terrain. Aids to good flying have been developed and a radio-altimeter has been tested. The possible use of a 360° circle panoramic view from a helicopter is visualized and there are possibilities in a method of aerial triangulation in which a plane with a three-camera mount tows a glider. The mounts are gyroscopically controlled and take a vertical, oblique, and horizontal photograph in the line of flight, those from the plane being directed backwards, and from the glider forwards.

G. D. H.

3. New Land Surveying Tool. C. J. Deegan. *Oil Gas J.*, 22.11.47, **46** (29), 75.—A new stadia traverse and elevation measurement surveying instrument has been devised in which a 35-mm film camera, fitted with vertical and horizontal lenses, photographs the stadia rod and a magnetic needle simultaneously. A mil scale grid is automatically printed on each negative. All computations are made from the film which is examined through a standard magnifying device. Normally readings can be taken with angles up to 5° above or below the horizontal. An accuracy of 3 ft in 1000 ft is claimed and the ability to measure vertical angles within 6 sec of arc.

It is claimed that the main advantage over the conventional transit is a saving of time, because the reading time is shorter, no notebook entries are needed, and there is no need to check observations by a return to the field. All computations are done in the office. The photographs may also be of use in identifying survey lines and property markers. They may be of special value in geophysical and geological work.

G. D. H.

4. The Atlantic Coastal Plain Geology, Its Geology and Oil Possibilities. H. G. Richards. *World Oil*, 15.9.47, **127** (3), 44.—Since the war began 3 wells have been drilled in Maryland, 10 in North Carolina, 21 in Georgia, and over 40 in Florida, in addition to wells drilling in Georgia and Florida. All except five at Sunniland, Florida, were dry.

Upper Cretaceous and Eocene to Pleistocene beds occur in the coastal plain of New Jersey. The dip is coastwards. The maximum thickness may be about 6000 ft on the coast. In places Triassic underlies coastal plain deposits. A few wells have been drilled. Conditions in Delaware are very similar. Eocene beds occur. A well reported a fair show.

In Maryland the Lower Cretaceous becomes marine towards the east. The first significant oil test was drilled in 1944 and met basement at 5529 ft. Triassic was found. A later well found basement at 7157 ft.

Lower Cretaceous outcrops in Virginia, and the same is true of Middle Eocene. The basement dips coastwards. In North Carolina the basement and higher formations rise sharply near Cape Fear (Great Caroline Ridge). Basement highs are known. Cretaceous, Eocene, Miocene, and Pliocene beds are present. The Middle Eocene is thin in North Carolina, and Upper Eocene, Miocene, and Pliocene outcrop. A gas show was found at 720 ft in a well near Havelock, Craven County. In July, 1946, a

stratigraphic test at Cape Hatteras met basement at 9878 ft. No oil or gas shows were found. A number of other wells have been drilled.

South Carolina has outcrops of Oligocene, in addition to the formation, found in North Carolina. Wells have found Trias below the Cretaceous. No oil or gas was found in tests drilled on the south flank of the Carolina Ridge; all met basement at less than 1500 ft.

Upper Cretaceous to Pleistocene beds outcrop in Georgia, and the basement dips southward. Marine Jurrassic has been recognized, with Palæozoic below the Cretaceous in some areas. G. D. H.

5. Anadarko Basin Geology and Oil Possibilities. R. R. Wheeler. *World Oil*, 22.9.47, **127** (4), 38; 29.9.47, **127** (5), 33.—The central Kansas and Ozark highlands were apparently uplifted repeatedly before the formation of the Arbuckle–Amarillo folds, and this the Andarko basin is a subdivision of a much larger southern Oklahoma geosyncline. It has oil possibilities ranging from Cambrian to Permian. At its deepest the Basin may have 28,000 ft of sediments and about 15 miles south of this point the basement outcrops. The northward thinning is more gentle. The eastern limit of the basin is the Oklahoma City uplift and the western Arbuckles. The basin can be subdivided into the Anadarko trough, the Southeastern Embayment the Central Basin flank, the Northern Shelf and the Dodge City Embayment.

The history of oil exploration in the Anadarko Basin is briefly described. Possible reservoir rocks include the Reagan sandstone, Arbuckle limestone, Simpson group, Viola Limestone, Sylvan Formation, Hunton group, the "Boone," "Chester," and "Chat" of the Mississippian, the Early Pennsylvanian, Upper Pennsylvanian, and the Permian. These are briefly described. Notes are given on their stratigraphical relationships, and on where they have been tested. Isopachyte maps show the thicknesses of various series, a map gives the pre-Woodford palæogeology, and a map and section show the Ordovician and Upper Pennsylvanian correlations, respectively. G. D. H.

6. Mississippi has Important New Pay. Anon. *Oil Gas J.*, 11.10.47, **46** (23), 225.—Thirty miles southwest of the Eucutta field, in 29-6n-11w, Jones County, Mississippi, a drill-stem test in the Lower Glen Rose at 12,880–12,904 ft, 12,931–12,927 ft, and 12,937–12,951 ft has flowed 112 brl of 42° oil in 8 hr, with a gas/oil ratio of 1258. The top choke was ¼ in and the bottom choke ¾ in. Some 10° oil was found in the Eutaw at 7305–7338 ft.

The Eutaw was topped at 7305 ft, Tuscaloosa at 7345 ft, Marine Tuscaloosa at 8233 ft, Massive sand at 8727 ft, top of anhydrite at 12,711 ft, and possibly the Rodessa pay at 12,883 ft. The structure is believed to be a deep-seated salt dome. G. D. H.

7. Past and Future of Oil Exploration in Rocky Mountain Area. J. G. Bartram. *Oil Gas J.*, 11.10.47, **46** (23), 178.—By 1946 the older-known structures of the Rocky Mountain area had been well picked over, and the search has turned to finding new folds in Tertiary filled basins.

In the earlier periods there was much calcareous sedimentation in the Rocky Mountain geosyncline, with some shale and sandstone, but later shales predominated with some sandstone.

Three new oilfields have been found in the Big Horn Basin Tertiary area; a gas field has been opened in the Wind River Basin, and a gas distillate pool in the Green River Basin. Showings of oil have been found in tests of Tertiary covered areas in other basins. The new pools are in Cretaceous and Permian rocks at depths of 8,000–12,000 ft.

The cost of geophysical work now proceeding in the Rocky Mountain area is about $1,000,000 per month. G. D. H.

8. Anton, Irish Fields May Connect. C. J. Deegan. *Oil Gas J.*, 1.11.47, **46** (26), 83.—The Anton field of southeast Lamb County and the Irish field of southwest Hale County, Texas, have, respectively, 9 and 18 producing wells. They lie on local highs on a east–west geophysical anomaly. It is possible that production will be found in

the intervening saddle. The Anton discovery well was completed in the Clear Fork after finding the Ellenburger dry.

The top of the pay is at 5500–6200 ft in this field. The oil is 29–30° gravity and the producing section is 100 ft thick. Most wells are equipped with pumps.

Reserves may be 10,000,000 brl or as much as 25,000,000 brl. G. D. H.

9. Possible Big Clear Fork Pool in West Texas. Anon. *Oil Gas J.*, 18.10.47, **46** (24), 167.—There are signs of continuous Clear Fork production over a wide area in the Goldsmith field, Ector County, Texas, and in a deep test in the Andector field a drill-stem test of the Clear Fork showed oil. The Clear Fork may produce over an area 13 miles long from north to south.

A regional high extends about 25 miles north and northwest from the south end of Goldsmith. On it are local highs which seem to determine the presence or absence of Upper Permian pays. They may not cut out the Clear Fork. The high has several areas of Devonian and Ellenburger production. The Devonian may be eroded on top of the structure, leaving the Ellenburger immediately below the Permian. The axis of the high is curved, and the east flank is steep. G. D. H.

10. Wheeler Pool Deep but Profitable. C. J. Deegan. *Oil Gas J.*, 8.11.47, **46** (27), 61.—The Wheeler pool lies in Ector and Winkler counties, West Texas. Thirty-four producing wells yield oil from the Ellenburger, Silurian, and Devonian chert. The Ellenburger is about 10,500 ft deep and the Devonian 8500 ft. There seems to be a narrow north–south anticline roughly parallel to TXL and Goldsmith.

The productive area may be 2500 acres. The Devonian wells need two-stage 8000-gal acid treatment, and the Ellenburger wells require a small acid wash. Dual completions cost about $205,000 each.

The original Ellenburger reservoir pressure was about 4550 p.s.i.; the Devonian reservoir pressure may have been 3600 p.s.i. G. D. H.

11. Rose Hill—First Production in Virginia—First East of Appalachian Plateau. R. L. Miller. *Oil Gas J.*, 8.11.47, **46** (27), 78.—Some 30 wells have been drilled at Rose Hill, Lee County, Virginia. The daily output was 400 brl in January 1947. Most of the surface rocks belong to the Cumberland overthrust. Erosion has cut through the overthrust along the Powell Valley anticline. Lower Cambrian to Upper Devonian rocks are exposed.

Oil has been found only below the Pine Mountain overthrust fault. Throughout much of the area the overthrust lies at or near the base of the Maynardville limestone.

All but one of the 15 producing wells drilled to March 1947 were in the Fourmile fenster. Several of the 8 wells drilled in the Possum Hollow fenster have had shows in the Clinton shale, Clinch sandstone, and Trenton limestone. One well at Rose Hill is believed to produce from the Moccasin limestone, the rest from the Trenton. Most wells are pumpers. The oil is about 44·5° A.P.I. The oil is thought to be in fractures in the limestone caused by shattering during folding and thrusting.

Production may be extended to the northeast and east from the Fourmile and Martin Creek fensters. G. D. H.

12. Deep Cretaceous Oil in Wyoming. Anon. *Oil Gas J.*, 27.9.47, **46** (21), 133.—Light sweet oil has been found in the third Frontier sand on the South Sand Creek structure, Washakie County, Wyoming. Production rates of several hundred brl of 48·5-gravity oil per day have been noted, with gas/oil ratios exceeding 2300. G. D. H.

13. Modern Exploratory Tools being Used in Five-Company Bahama Oil Search. W. W. Burns. *Oil Gas J.*, 8.11.47, **46** (27), 38.—A regional airborne magnetometer survey in the Bahamas is nearly complete. Gravity and seismic work has also been executed and Superior drilled a well to 14,585 ft on northern Andros. The well is said to have reached Lower Cretaceous which resembled that of southern Florida. The technique used in controlling the magnetometer survey is briefly described. G. D. H.

14. Two More Spring Hill Tests being Drilled. Anon. *Oil Gas J.*, 4.10.47, **46** (22), 43.—The ninth and tenth Spring Hill, Chile, wells are being drilled. No. 8 has been completed and its potential may be about 700 brl/day. G. D. H.

15. World-Wide Oil Developments. Anon. *Oil Gas J.*, 22.11.47, **46** (29), 42.—A new field has been found in the Petit Jean area, French Morocco. The discovery well has an output of 126 brl/day. Morocco's production is less than 23,000 brl/year.

No. 9 Spring Hill, Chile, has an estimated output of 600–700 brl/day from 6900 ft. G. D. H.

16. Oil and Gas Resources of Southern Border of European Part of U.S.S.R. I. O. Brod. *Oil Gas J.*, 27.9.47, **46** (21), 62.—In the central region of the Russian platform the pre-Cambrian basement has been found at 6560 ft. In the southeast there is an uplifted belt of pre-Cambrian running from the Voronezh massif to the Ufa platform. A buried range traceable in the Kalmyk–Salsk steppes is probably a plunging extension of the western slope of the Urals. The Managyshlak Mountains occur along the southern edge of the platform. They show Permian and Triassic folds.

There are numerous oil and gas occurrences in the Mesozoic of the Mangyshlak region.

At each phase of folding the structures became welded to the margin of the platform and it is possible that exploration will confirm in the southern part of the platform not only buried Hercynides and Mangyshlides, but also zones of Caledonides. G. D. H.

17. New Field Discovered by Arabian American. Anon. *Oil Gas J.*, 11.10.47, **46** (25), 49.—The Buqqua field has been discovered midway between Abqaiq and Qatif. No flow tests have been made, but the discovery well's potential is believed to be high. G. D. H.

Geophysics and Geochemical Prospecting.

18. Gravitational Methods of Prospecting for Oil. E. I. Robertson. *Petroleum*, July 1947, **10**, 155.—In this third article, methods for measuring gravitational force are discussed. The Gulf and Frost types of gravity meter are described. F. W. H. M.

19. Seismic Refraction Methods of Prospecting for Oil. E. I. Robertson. *Petroleum*, Aug. 1947, **10**, 170.—Details are given of the seismic methods of geophysical prospecting. F. W. H. M.

Drilling.

20. World's Deepest Producer. Anon. *World Oil*, 1.9.47, **127** (1), 27.—The well was drilled by the Texas Co. in the Lafouche Basin Levee District, and produces from a depth of 13,904 ft. The well history and mud programme are described in some detail. C. G. W.

21. World's Deepest Well. J. E. Kastrop and W. P. Sterne. *World Oil*, 8.9.47, **127** (2), 26.—The well, 17,823 ft deep, was drilled by the Superior Oil Co. of Calif., near Fort Cobb, Caddo County, Oklahoma. The well history, bit record, mud system, and power plant are described. C. G. W.

22. The D.V. Multiple Stage Cementer. R. E. Edwards and F. W. Nussbaumer. *Petrol. Engr*, July 1946, **18** (11), 80.—The construction and operation of a new type of multiple-stage cementer are described. R. B. S.

23. Cemented Liner Solves Problem of Testing Formations in Open Hole. J. E. Kastrop. *World Oil*, 29.9.47, **127** (5), 30.—It was desired to test a formation several hundred ft from bottom in an enlarged hole. The hole was plugged back and a liner, well covering the sand section, was set and cemented. The liner was washed out, cleaning the top of the liner, and the cement then allowed to harden. The cement plug inside the liner was then drilled, a gun perforator run to the sand section and shots

placed. A packer placed on the bottom of the drill stem was run, permitting a successful test of the formation.

Full details of the equipment and procedure used in setting the liner are given. C. G. W.

24. Diamond Bit Coring at Rangely. N. Williams. *Oil Gas J.*, 11.10.47, **46** (23), 141.—In a very hard section, it was found that coring with diamond bits was faster and cheaper than drilling with rock-bits. Cutting time 10–12 min/ft for diamonds compared with 30 min/ft for rock-bits. Use of larger diamonds and elimination of water-courses improved bit performance. Reduction in round trips is made by increasing the length of the barrel up to 90 ft. Use of single barrels and inner barrels types are compared. Reverse circulation may prove an important development as it enables an entire section to be cored without making round trips to recover cores. A rig adapted for reverse circulation coring is described, and field procedure adopted in coring outlined. C. G. W.

25. Planning a Multiple Well Directional Drilling Programme for Offshore Locations. J. G. Jackson and J. B. Murdoch, Jr. *Oil Gas J.*, 18.10.47, **46** (24), 133.—The article describes an example of the solution of planning a multiple well directional drilling offshore programme for given geological, mechanical, well-spacing, and marine structure conditions. C. G. W.

26. Application of Internal Combustion Engine Power to Rotary Rigs. W. S. Crake. *Oil Gas J.*, 11.10.47, **46** (23), 180.—Knowledge of characteristics such as load cycle and motion cycle is necessary in applying motive power to a rig. Load factors for hoisting, drilling, and auxiliaries are given. Effect of load characteristics on choice of prime movers, characteristics of transmissions, effect of hoist design, rotary drives, pump drives, and the desirability of portability are discussed at considerable length. C. G. W.

27. Problems in World's Deepest Fishing Job. F. Briggs. *World Oil*, 8.9.47, **127** (2), 36.—The job resulted when the drill-stem stuck at 17,226 ft. After more than a month's work, 16,970 ft of drill-pipe were recovered. Three inside and three outside cuts were made in the drill-pipe, two of the inside cuts being unsuccessful. The procedure and equipment used are described. C. G. W.

28. Utilization of Logging Data in Estimating Oil Reserves. I. Kogan. *Petrol. Engr*, July 1947, **18** (11), 54. (Paper published in *Azerbaidzhanskoe Neftianoe Khoziaistvo (Baku)*, 1935 (10–11), 15–20. Translated from the Russian by A. A. Boehtlingk.)—The calculation of oil reserves by the volumetric method and the use of electrical logging methods of obtaining the pertinent data are discussed. A description is also given of a special type of electrical logging instrument. R. B. S.

29. Electric Logging : a Study of the Self-Potential Curve. S. J. Pirson. *Oil Gas J.*, 4.10.47, **46** (22), 72.—The S.P. curve is the resultant of three main potentials—the Mounce or electrochemical potential, the streaming potential, and the diffusion potential. The nature of each of these potentials is described. In a rotary well the streaming potential is often absent because of the low permeability and uniformity of the filter cake.

A clean salt-water sand in contact with less saline water in the well will have a low Mounce potential and a high normal diffusion potential. A clean fresh-water sand in contact with more saline water will have a low Mounce potential and a reversed diffusion potential. A clayey salt-water sand will have a high Mounce potential (practically the same as for shales), a low electrofiltration potential, and a high diffusion potential of normal sign.

The discussion of the potentials is very full. G. D. H.

30. Electric Logging : the Resistivity Curves. S. J. Pirson. *Oil Gas J.*, 25.10.47, **46** (25), 94.—The principles underlying the measurement of resistivity in boreholes are described, and the features of the different electrode systems are enumerated. The standard three-electrode system with the potential electrodes below the current

electrode can log to the bottom of the well. The reversed three-electrode system has the current electrodes and one potential electrode in the well, and yields the normal curve.

In the four-electrode system both current and both potential electrodes are in the well. The two-electrode system has one current and one potential electrode in the well, and the others at the surface. The single-electrode system has a current electrode in the well and one at the surface. G. D. H.

31. Electric Logging : the Factors which Affect True Formation Resistivity. S. J. Pirson. *Oil Gas J.*, 11.1.47, **46** (26), 76.—The resistivities of various packings of uniform spheres with 100% water saturation are calculated, and are inversely proportional to the porosities. In cemented rocks this proportionality no longer holds.

Composite curves for the resistivity of connate water versus bulk salinity have been prepared for conditions commonly met in oilfields, since samples of connate water are frequently not available for resistivity measurements.

In incompletely water-saturated rocks the resistivity is influenced by fluid distribution ; it is not merely a function of degree of saturation. The resistivity is practically infinite for water-saturations below about 10%.

Electric logs give only apparent resistivity. G. D. H.

32. Application of Carboxymethylcellulose in Drilling Muds. J. R. Pettigrove. *Oil Gas J.*, 11.10.47, **46** (23), 170.—Advantages claimed for use of Driscose (sodium carboxymethylcellulose) are (1) low water losses, thin filter cakes ; (2) less weighting material required ; (3) resistance to contamination ; (4) reduced volumes required ; (5) reduction in bentonitic dispersion ; (6) wide application and easy control ; (7) lower total mud costs. C. G. W.

33. Control of Mud Properties in Drilling Anhydrite. G. R. Gray. *Petrol. Engr*, June 1947, **18** (9), 142. (*Paper presented at Drilling Fluids Conference, Texas A. and M. College, College Station, Texas*, May 1946.)—The deterious effects of anhydrite on the properties of drilling muds are discussed : these are a result of the flocculation of the clay particles. The use of (1) alkalies and quebracho, and (2) phosphates, are not usually successful in controlling mud properties under these conditions, owing to the production of soluble sodium sulphate by the reactions which take place. The control of anhydrite can be accomplished chemically by the use of barium carbonate which removes the anhydrite according to the following reaction :

$$BaCO_3 + CaSO_4 \longrightarrow BaSO_4 + CaCO_3.$$

Both of the reaction products are practically insoluble. Another method of overcoming anhydrite troubles is by the use of organic colloids. These compounds reduce the water loss by mechanical, as opposed to chemical means, and the anhydrite, as such, is not removed as with the chemical method.

The benefits derived from improved mud control in drilling anhydrite include : (1) saving time on fishing jobs ; (2) saving on casing ; (3) saving on time required to drill a well ; and (4) more reliable information for completion. These are each briefly discussed. R. B. S.

34. Use of Oil-Emulsion Mud in the Sivells Bend Field. W. H. Echolls. *Petrol. Tech.* July 1947, **10** (4), *A.I.M.M.E. Tech. Pubn. No.* 2227, 1–9.—An oil-emulsion mud, consisting of a mixture of oil-base mud and bentonitic water-base mud, has been used in the Sivells Bend field, Crooke County, Texas. Experience indicates that the oil-emulsion mud can be controlled in much the same manner as a water-base mud, and the " drilling " functions of the two types of mud are comparable. The average water-loss for the oil-emulsion mud was 3·8 cu. cm.

There are no data to show that well productivities have been affected by the use of oil-emulsion mud. Productivity indices were not available, and the sand permeabilities of 75 to 375 mD may have been high enough to permit infiltered muds being flushed out when the wells were put on production. Drilling time and bit footages were increased and the holes kept more closely to bit size by the use of oil-emulsion mud. When using oil-emulsion mud to drill the last 2000 ft of 7000-ft wells, the mud

costs were about two and a half times that for water-base mud, the added cost being approximately 4–5% of the per well development cost. The apparent advantages gained through the use of oil-emulsion mud in the Sivells Bend field do not appear to justify the increase in mud costs. G. D. H.

35. Oil-Base Drilling Fluids. G. Miller. *Petrol. Engr, Reference Annual*, 1947, **18** (10), 84. (*Paper presented before A.I.M.E., New York*, March 1947.)—The author first discusses the requirements and preparation of oil-base drilling fluids: the nature of the mixing oil will have a considerable effect on the final properties of the drilling fluid. The weight of the mud will vary with the gravity of the oil; the viscosity will vary with the gravity and acidity of the oil, the gel strength will vary with the acidity, aromatic content, gravity, boiling points, aniline point, and surface tension of the oil; and the plastering properties will vary with the aniline point, acidity, gravity, aromatic content, surface tension, and lighter fraction content of the oil.

The alterations which have to be made in conventional types of electrical logging equipment in order to be able to run electric logs, and the comparative effects of oil-base and water-base muds on the size of hole drilled are also discussed. A bibliography of fifteen references is appended. R. B. S.

36. Desanding Drilling Fluids. J. E. Kastrop. *World Oil*, 25.8.47, **126** (13), 30.—It is desirable to remove suspended sand from drilling fluids, owing to the effect on the properties of drilling muds and the abrasion of equipment. A centrifugal desander is described, which effects separation by causing sand-laden fluid to swirl at high velocities inside a volute or cyclic chamber. The sand particles accumulate at the boundaries of the volute and settle to the bottom. Clean oil is piped from the centre of the volute to the mud sump. Construction and installation of the equipment are described. C. G. W.

37. New British Slush Pump. Anon. *Petroleum Times*, 8.11.47, **51**, 1109.—The leading features of a new British slush pump are briefly described. R. B. S.

38. Resistivity Curves. S. J. Pirson. *Oil Gas J.*, 25.10.47, **46** (25), 94.—Various electrode arrangements in use for resistivity measurements are here illustrated. Such systems are the three-electrode, which may be standard, inverted, reversed or reversed-inverted, four-electrode systems, two-electrode, and single-electrode systems. Equations are derived for calculating the resistivity for each system. C. G. W.

39. Reverse Circulation Drilling in West Texas. G. Weber. *Oil Gas J.*, 11.10.47, **46** (23), 147.—The principal reason for use of reverse circulation is to provide larger cuttings for examination. Cuttings are larger, greater velocity permits closer correlation, and sample contamination is reduced. Secondary results are increased footage per bit, reduced overall time, and more accurate hole gauge. The results from which these conclusions were drawn are presented in tabular form. Limitations are (1) loss of circulation may occur; (2) soft formations may tend to ball the bit. C. G. W.

40. Rock-bit Design and Experimental Data. W. B. Noble. *Oil Gas J.*, 18.10.47, **46** (24), 118.—Design of a rock-bit is a problem of balancing diameters, lengths, and angles of axes of cutters. For a given cutter diameter, a proper balance between tooth depth, shell thickness, bearing diameter, and journal diameter is necessary for maximum bit life. The selection and treatment of materials are also of the greatest importance. The fundamental considerations in design are: (1) space requirements; (2) materials; (3) tooth design; (4) hard metal selection and application; (5) bearings; (6) tolerances; (7) surface finish of working parts; (8) frame of bit forgings castings, etc.; (9) nozzle assembly.

Laboratory test data relating rate of penetration, total penetration, rotary r.p.m., and load on bit are presented, and the data combined to illustrate optimum rotary r.p.m. and weight for maximum drilling efficiency in a given formation. It is thought that similar curves could be worked out for other formations and thus indicate optimum conditions for field work. C. G. W.

41. Modern Rotary Drilling. Parts 31 to 40. J. Zaba. *Oil Gas J.*, 2.8.47, **46** (13), 95; 9.8.47, **46** (14), 109; 16.8.47, **46** (15), 115; 23.8.47, **46** (16), 135; 30.8.47, **46** (17), 105; 6.9.47, **46** (18), 107; 13.9.47, **46** (19), 121; 20.9.47, **46** (20), 317; 27.9.47, **46** (21), 115; 11.10.47, **46** (23), 205.—These papers continue the series of articles on modern drilling. Subjects dealt with are: (31) Miscellaneous hoisting equipment; (32) Types of rotary drives; (33) Miscellaneous rotary drive equipment; (34) Power requirements; (35) and (36) Steam-generating plants; (37) Flexibility of steam engines, suited to drilling; (38) Internal combustion engines; (39) Diesel engines; (40) Compounding of engines. C. G. W.

42. Mobile Rotary Rig for S. America. N. A. Darcy, Jr. *Petrol. Engr*, July 1946, **18** (11), 74.—A description is given of semi-trailer mounted rotary drilling and pump units. R. B. S.

43. World's Safest Rig. G. H. Creighton. *Oil Gas J.*, 18.10.47, **46** (24), 110.—Various safety devices, developed to reduce or eliminate accidents, are mentioned. Such devices are: power or pneumatic slips, power hoist to replace cathead, automatic tong retractor, automatic tubing tongs, and a rig intercommunication system. C. G. W.

44. A Study of the Self-Potential Curve. S. J. Pirson. *Oil Gas J.*, 4.10.47, **46** (22), 72.—The fundamental physical principles involved in studying the self-potential log are dealt with at length. In a well filled with drilling fluid reactions of well fluid with the solid framework of rocks or with their fluid content may occur. In the first case we may have (1) preferential adsorption of ions of salts in solution; (2) ionization of adsorbed ions; or (3) selective adsorption of H^+ and OH^- ions from water. In any case the formation of a Helmholtz double electric layer and a fixed hydration layer results. The greatest possible potential difference between solid and fluid is given by the Nernst formula:

$$\epsilon = \frac{RT}{vF} \ln \frac{\alpha_1}{\alpha_2}$$

ϵ = electrochemical potential

$-ve$ and $+ve$ ions act as solutions of activities α_1, α_2.

R = gas constant, T = abs. temperature, v = valency, F = the Faraday.

The greatest possible potential difference in the movable water is termed the zeta potential. Depending on the distribution of ionic charges ζ may be $+ve$ zero or $-ve$, and is measured indirectly. The Mounce potential may be shown to be identical with the ϵ potential. Owing to the ϵ potential, large variations in S.P. may be found, even in the absence of electrofiltration and diffusion effects, thus explaining larger variations than can be ascribed to these effects.

It may be shown that the electrofiltration potential

$$E_s = 4\pi \frac{Kr \cdot \Delta P}{D\zeta}.$$

Kr = effective permeability to fluid flowing, ΔP = pressure drop from well to formation, D = dielectric constant of fluid, ζ = zeta potential. Relations between E_s, permeability, and grain size are illustrated and applications to cable tool and rotary logs discussed. Other effects discussed are diffusion, formation, and electrode potentials. The application of combined potentials in explaining the S.P. log is illustrated by an example. C. G. W.

Production.

45. Acoustic Well Depth Indicating. A. Wolf. *World Oil*, 22.9.47, **127** (4), 35.—One of the more important factors in operation is the height of fluid column. By means of a sound pulse, the fluid level may be accurately located without interrupting normal operations. A blank cartridge is fired in a small gas-tight chamber attached to the well-head. The sound is partly reflected from tubing collars and other obstructions, and is almost totally reflected at the fluid surface. Reflected sound is picked up and continuously recorded. The fluid level is located relative to the nearest tubing collar. The history of the acoustic method, the wide applicability and ease of operation of the instrument are discussed, and an example of a well sound-log presented. C. G. W.

46. Oil Production from Long Cores by Air–Gas Drive. R. J. Day. *World Oil*, 11.8.47, **126** (11), 36.—See Abstract No. 808 (1947).

47. Vented Casing-head Gas. L. T. Potter. *Petrol. Engr*, July 1947, **18** (11), 48.—The economical aspects of the casing-head gas problem are briefly discussed.

R. B. S.

48. Method for Determining Connate and Drilling Water Saturation for Cable Tool Cores. A. P. Clark. *Producers Monthly*, July 1947, **11** (9), 11. (*Paper presented before Eastern District Division of Production, A.P.I., Pittsburgh*, April 1947.)—A description is given of a method of analysis which resolves the total water in an oil sand into its three possible components: drilling, connate, and flood or other extraneous water. The method depends on the use of dextrose as a tracer in order to determine the drilling water content: the determination of the salinity of the connate water and the salt content of the core enables the connate water content to be calculated: the extraneous water is then the difference between the total water, determined by extracting the core, and the sum of the drilling and connate waters.

The procedure adopted in all the experimental measurements is described. Oil and water saturations were determined simultaneously by a single extraction in ground-glass joint apparatus using a close-cut naphtha: porosity and pore volume were determined by a bulk volume method of sufficient accuracy to justify the use of sand density for determining the pore volume of the total extracted sample, rather than that of a small sample assumed to be representative: the dextrose content of the core was determined by using a portion of the unextracted sample owing to the loss of dextrose during the extraction with naphtha. If the sand being cored is making water the dextrose concentration of the drilling water does not remain constant, but is continually reduced during the entire run: it was therefore calculated from the concentrations at the beginning and end of each run on the assumption that the reduction was uniform from top to bottom. The total salt in the core was determined by an electrolytic conductivity dip cell instead of the lengthy and tedious method of chemical titration. The connate water salinity was determined by one of three methods, viz.: (1) Determination of the salinity of the water in a low permeability core sample which has been subjected to a negligible amount of contamination by drill or flood-water; such samples can be obtained from tight sand sections; (2) Determination of the dextrose content and salinity of the drilling water and of the water bailed from the hole after standing overnight, from which data the salinity of the water entering the well can be determined: this method is only suitable when an unflooded sand is being cored; (3) Sampling the water from a natural producing well: this is the least satisfactory method.

The analyses of two typical wells are given to show the interpretation of the data taken by this method. The more accurate knowledge of reservoir saturations thereby obtained enables reservoir behaviour to be more accurately predicted. Seven references are appended.

R. B. S.

49. Corrosion Leaks in Producing String Remedied. E. Short. *Oil Gas J.*, 11.10.47, **46** (23), 197.—The tool used provides a means of connecting on to the producing string with new casing, after the upper portion of corroded casing has been removed. The tool consists of a guide shoe, wash-over nipple, rubber packer, and slip guides to hold the casing in the centre of wash-over pipe, and circulation mechanism. The tool is run over good casing. Cement is pumped and slips set and packer collapsed. After setting, the cement is drilled out, leaving a tight, strong seal.

C. G. W.

50. Preventing Corrosion in Gas-Condensate Wells. P. L. Menaul and P. P. Spafford. *Petrol. Tech.*, July 1947, **10** (4), *A.I.M.M.E. Tech. Pubn. No.* 2229, 1–8.—Organic acids appear to be the chief agents in the severe corrosion detected in condensate wells. The injection of ammonium hydroxide has proved effective in preventing gas-condensate well corrosion. In some cases as little as one quart per day of ammonium hydroxide has proved effective. The injection of " bone oil " has been successful in cases where wells produce brine with the hydrocarbon condensate. Data are given on wells which have had this chemical treatment.

Wells subject to corrosion can be detected by chemical analysis of the water produced. The presence of iron indicated corrosion. When chemical treatment is instituted tests should be made for the presence of the injected chemical to ensure that it is circulating. The analyses also give guidance with respect to the optimum rate of chemical injection.
G. D. H.

51. Some Uses and Limitations of Model Studies in Cycling. D. L. Marshall and L. R. Oliver. *Petrol. Tech.*, July 1947, **10** (4), *A.I.M.M.E. Tech. Pubn. No.* 2230, 1–21.—The results of a series of model studies on recycling are described. Such studies are very helpful in the design and direction of a cycling operation. Each case must be treated on its merits. The accuracy of the invasion pattern predictions depends on (*a*) the accuracy with which the configuration of a reservoir, its pay thickness, porosity, interstitial water content, and permeability are known, and (*b*) the accuracy of the production and injection data. When a model study has not been made and is not warranted, recycling may be undertaken cautiously by making full use of production data and the experience gained elsewhere. Under these conditions it is practically impossible to predict invasion patterns or to integrate an entire recycling programme, and recoveries may be expected to be lower than in a fully planned and controlled operation.
G. D. H.

52. Condensate Production and Cycling. Part 1. P. J. Jones. *World Oil*, 11.8.47, **126** (11), 32.—Reservoir gases may be dry, wet, or retrograde. In the case of retrograde, a decline in pressure below dew-point pressure is accompanied by condensation, to a minimum condensation pressure. Laboratory investigations are characterized by constant weight and variable volume, whereas in the case of a declining reservoir pressure, the volume, neglecting water encroachment, is constant and the weight variable. A procedure for applying experimental data to reservoir condensation is given. Three examples of retrograde gases are given.
C. G. W.

53. Condensate Production and Cycling. Part 2. P. J. Jones. *World Oil*, 18.8.47, **126** (12), 130.—Equations and graphs are presented illustrating the relations of (1) Product in condensed liquid phase; (2) Cumulative gas recovery; (3) Cumulative liquid recovery to reservoir pressure for the three gases A, B, and C of Part 1. Results are compared to show the effect of original composition on condensate recovery. The influence of pressure maintenance on condensate recovery is shown graphically for two gases, and the effect of water encroachment briefly discussed.
C. G. W.

54. Condensate Production and Cycling. Part 3. P. J. Jones. *World Oil*, 25.8.47, **126** (13), 32.—This article deals with invasion by injected gas. Cumulative recovery at the time dry gas reaches a producing well is called break-through recovery:

$$C = p(ah)m.$$

C = cumulative recovery, ah = acre ft invaded by dry gas, p = in place rich gas ft³/acre ft, m = displacement factor, *i.e.*, the fraction of in place gas displaced from the acre ft invaded by dry gas. Break-through recovery as a fraction of in place gas is given by $C = Im$, where I = invasion factor, *i.e.*, acre ft invaded by dry gas/acre ft to be invaded. Equations are derived for radial and linear injection systems.

$$I_1 = D_1^2 = \frac{(mK)_1}{(mK)_J} \qquad I = \frac{\Sigma h_1 I_1}{\Sigma h_1}$$

$$I_1 = L_1 = \frac{(mK)_1}{(mK)_J} \qquad I = \frac{\Sigma h_1 I_1}{\Sigma h_1}$$

where D and L are radial and linear distances advanced by dry gas in any interval, h = completion in any interval, K_1 and K_J are the permeabilities of intervals I and J, J being the most permeable interval in the pay. An example of the application of these equations is given.

The shape and size of the invasion patterns for a one well system and the data on the unit injection circle are also reviewed.
C. G. W.

55. Condensate Production and Cycling. Part 4. P. J. Jones. *World Oil*, 1.9.47, **127** (1), 32.—In terms of the unit injection circle, the break-through area for bounded conditions cannot exceed $CN/N + 2$, where C = constant, N = no. of injection wells. For 360° per injection well, the break-through is $C/3$, hence for $360/N$ degrees per injection well the break-through area as a fraction of the break-through area for 360° per injection well is given by $B = \frac{3}{N+2}$.

This relation is plotted graphically. Reduced break-through patterns are shown and the relation of reduced break-through pattern to degrees per injection well is plotted.

A procedure for estimating an invasion pattern relative to boundaries and interference between injection wells is given and illustrated for symmetric and asymmetric conditions. C. G. W.

56. Condensate Production and Cycling. Part 5. P. J. Jones. *World Oil*, 8.9.47, **127** (2), 40.—Break-through recovery of rich gas by displacement is 74%. The position of the break-through section depends on the distance advanced by injected gas and is called B, the break-through contour. Maximum rich gas recovery by displacement and diffusion is 98%. The position of the maximum recovery section is M, the maximum recovery contour. If the displacement factor for a $B - M$ region is m_b, then

$$m_b = \tfrac{1}{4}[U_0(C + 2) + U_b(4 - C)].$$

U_0 and U_b are maximum and break-through recoveries. Assuming values of 98% and 74% respectively

$$m_b = 82 + 4C,$$

where C = convergence $= \frac{B - M}{500}$.

For radial advancement of the B contour with constant pay thickness

$$M = (250{,}000 + B^2)^{\frac{1}{2}} - 500.$$

For combined $B - M$ and M regions,

$$m = 82 + 8A.$$

$$A = \frac{M}{B} + \left(\frac{M}{B}\right)^2$$

A plot is made of m vs. average distance advanced by dry gas given by $B = 117{\cdot}8(a)^{\frac{1}{2}}$, a = acre ft invaded. Equations are derived and graphs plotted relating cumulative liquid recovery, B.P.M.M., and cumulative gas recovery.

The economic limits of cycling, illustrated by an example, are also discussed. C. G. W.

57. Condensate Production and Cycling. Part 6. P. J. Jones. *World Oil*, 15.9.47, **127** (3), 52.—The equations derived in the last section for calculating liquid recovery and composition, namely, $x_1 = e^{-(F_1 - b_1 m_1)/(1 - b_1 m_1)}$, $c_1 = 1 - (1 - b_1 m_1)x_1$, where x_1 = composition of production, $b_1 m_1$ = break-through recovery, v_1 = produced gas, C_1 = cumulative liquid recovery, are here applied to several wells in one interval, one well in several intervals, and several wells in several intervals. The procedure for converting from a per-interval basis to a per-well and per-reservoir basis is described and examples given. C. G. W.

58. Condensate Production and Cycling. Part 7. P. J. Jones. *World Oil*, 22.9.47, **127** (4), 32.—This section reviews gas displacement by water injection. For production purposes, relative permeabilities are expressed in terms of fluid displacement. For gas displacement by water, relative permeabilities are given by $kg = (1 - C)^2$, $kw = C^3$, where C = displaced rich gas.

Volume fractions of gas and water in production are given by

$$W = \frac{Qw}{Qw + Qg} = \frac{1}{1 + \frac{\mu w}{\mu g}\frac{(1 - C)^2}{C^3}}$$

$$G = \frac{Qg}{Qw + Qg} = \left[1 + \frac{\mu w}{\mu g}\frac{C^3}{(1 - C)^2}\right]$$

Total water requirements per brl of rich gas are given by $\frac{1}{r}\left[1 + \frac{W_0}{C}\right]$, where W_0 = cumulative water recovery, C = cumulative rich gas recovery.

W_0 may be calculated as follows:

$$\frac{dC}{d(C + W_0)} = C_1$$

$$C + W_0 = \int \frac{dc}{C_1}$$

$$W_0 = \frac{\mu g}{\mu w}\int_0^C \frac{C^3 dC}{(1 - C)^3}$$

$$W_0 = \frac{\mu g}{\mu w}\left[\frac{6C - 3C^2 - C^3}{2(1 - C)} + 3\log(1 - C)\right]$$

Expressions for break-through and maximum recoveries are derived in terms of viscosity ratios.

$$\frac{(1 - U_b)^3}{U_b^3} = 19 \cdot \frac{\mu g}{\mu w}$$

$$\frac{(1 - U_0)^3}{U_0^3} = 0{\cdot}01\,\frac{\mu g}{\mu w}$$

U_b and U_0 are break-through and maximum recoveries. Graphical solutions of all derived equations are presented. C. G. W.

59. Condensate Production and Cycling. Part 8. P. J. Jones. *World Oil*, 29.9.47, **127** (5), 58.—Recovery by water injection, prior to break-through, may be up to 96% of in place butanes plus. The displacement factor for a $B - M$ region is given by

$$m = \tfrac{1}{4}[U_0(C + 2) + U_b(4 - C)].$$

If $U_0 = 98\%$ and U_b is expressed in terms of viscosity ratio, then

$$m = 62{\cdot}7 + 8{\cdot}8c + \left(\frac{\mu w}{\mu g}\right)^{\frac{1}{3}}(2 - 0{\cdot}5C) \quad (C = \text{convergence}).$$

Graphs are presented relating m to C for various values of $\left(\frac{\mu w}{\mu g}\right)$.

Gas recovery c in % of in place rich gas within the invaded acre ft is given by

$$C = S(98 - m) + m,$$

where the acre ft of gas pay down dip from an M contour is a fraction S of the invaded acre ft. Solutions of this equation are given for a value of $C = 1{\cdot}2$ and a no. of viscosity ratios.

Equations for break-through recovery and the water required are given, and the economics of water injection and cycling discussed. The majority of influential factors are in favour of water injection, but for a given rate of rich gas production more injection wells are required than for gas injection.

The no. of injection wells required is given by

$$N = \frac{ABQ\,\mu \log_{10}\frac{2d}{r}}{3{\cdot}07(IhK\Delta P)}$$

where d = average distance from injection wells to producing wells ft, h = average completion for N, injection wells ft, I = interference factor for injection wells, K = average permeability to water at wells darcy's, $\Delta P = P_w - P_R$ = average per-well build-up p.s.i., P_R = reservoir pressure p.s.i.a., P_w = operating bottom hole injection pressure p.s.i.a., μ = viscosity of water cps, r = radius of injection wells ft.

C. G. W.

60. Engineering Fundamental, No. 307. Solubility of Gas in Crude Oil. J. C. Calhoun. *Oil Gas J.*, 8.11.47, **46** (27), 87.—Estimations of changes in compressibility, amount of gas solubility, change in liquid volume upon gas solution, and viscosity,

can be made by empirical correlations. Two basic means of evolving gas from reservoir oil are recognized, the "flash" and "differential" gas liberation. The density of stock tank oil and of the gas evolved will vary according to the manner of gas liberation. Two charts illustrate the script. G. A. C.

61. Well Flowmeters for Logging Producing Ability of Gas Sands. R. P. Vincent, R. M. Leibrock, and C. W. Ziemer. *Petrol. Tech.*, Sept. 1947, **10** (5), *A.I.M.M.E. Tech. Pubn. No.* 2263, 1–10.—The Stanolind flowmeter uses a hot-wire anemometer connected in a wheatstone bridge circuit, and has proved valuable in measuring in gas wells. The instrument provides a direct and accurate means of analysing reservoir performance by determining the gas velocities in the well bore above each producing sand.

Tests in the Hugoton gas field of western Kansas have shown some unusual producing characteristics. In two instances it was found that all or most of the gas was coming from one section in the well where four pay sections had been perforated. The results frequently contradict the inferences drawn from electric logs and core analysis, and thus demonstrate the need for accurate measurements of the volume of gas coming from each producing horizon. G. D. H.

62. Marble Blasting Conserves Reservoir Characteristics. J. G. Burch. *World Oil*, 15.9.47, **127** (3), 33.—The drilling process causes severe congestion at the face of the bore. As production proceeds, paraffin and mineral deposits accumulate on the surface of the pay section. Simple cleaning methods are effective in early stages, but are not effective when encrustment becomes dense. The agate torpedo is severe enough to remove all production-retarding substances. The principle is similar to sand-blasting. Solids are propelled at high velocity against the wall of the well. These solids are unharmed at detonation, penetrate the formation slightly, and then disintegrate violently. The method is compared with shooting, and the experiments tried described. Requirements of solids are that they shall be elastic enough to remain undamaged at the instant of detonation and slightly penetrate the formation, and sufficiently frangible to disintegrate entirely after penetration. Heat-treated glass marbles are found to be satisfactory.

Applications of the method and the dimensions of the equipment are described. C. G. W.

63. Sub-Surface Sucker Rod Pumps. Factors in Selection and Use. R. L. Chenaults *Oil Gas J.*, 18.10.47, **46** (24), 104.—Classification of pumps and typical pump assemblies are described. The effects of fluid slippage, presence of gases and vapours, corrosion and rod and tubing stretch on pump performance are discussed and illustrated. C. G. W.

64. Hydraulic Pumpers for Shallow Wells. A. A. Hardy. *Oil Gas J.*, 25.10.47, **46** (25), 102.—The hydraulic pumper consists of a horizontal, double-acting hydraulic cylinder placed in the rod line between two or more wells. Reversals are effected by a piston type four-way master valve. Reversals of the master valve are effected by a pilot valve which alternates intake and exhaust pressure on the ends of the four-way master valve. The pilot valve is actuated by small spring-loaded pistons inserted on each cylinder-head of the main cylinder. Required volume and pressure of power oil, selection of power unit, and means of obtaining smooth reversals of flow are described. Volumetric efficiency of the pump is about 94%. C. G. W.

65. New Methods Needed to Produce More Oil. R. D. Shrewsbury. *World Oil*, 1.9.47, **127** (1), 29.—Present-day production methods result in the removal of only a small proportion of the oil in reservoirs. In view of the increasing demands it is essential to develop new methods of production. The author postulates that present recovery methods are fundamentally wrong and that a better appreciation of the origin, migration, and accumulation of petroleum is desirable. C. G. W.

66. Decline Curves. H. M. Ryder. *Producers' Monthly*, June 1947, **11** (8), 28.—A description is given of a method of analysing decline curves in order to predict: (1) the approximate daily oil production at any selected future date; (2) the approximate

time at which the daily oil production will drop to a selected value; and (3) the approximate quantity of oil which will be produced during any selected period of time or until the daily oil production drops to some selected value. The deductions which can be made from a study of the characteristics of the decline curves are also discussed. Two references are appended. R. B. S.

67. Calculated Effect of Pressure Maintenance on Oil Recovery. R. L. Hass. *Petrol. Tech.*, Sept. 1947, **10** (5), *A.I.M.M.E. Tech. Pubn., No.* 2231, 1–10.—Muskat's differential equations are applied to predict the performance of the Fullerton field which is believed to be under dissolved-gas drive. Under primary depletion the field may be expected to produce 14,030 brl/acre. In one case the performance was computed for a return of 35% of the produced gas, and the recovery was estimated at 15,910 brl/acre. For 60% return the injection was supposed to cease when a gas/oil ratio of 22,000 cu. ft/brl was attained, and thereafter there was primary depletion to the end of the producing life, giving a total recovery of 17,190 brl/acre.

Throughout it was assumed that the fluid properties are the same at all points in the reservoir, and that the core data are typical of the Clear Fork limestone in the locality. It was also assumed that the injected gas was completely diffused through the pay zones.

Examination of the economics of the three recovery programmes considered indicated that the one involving re-injection of 60% of the produced gas would be most profitable.

A sample calculation is given in detail. The calculations are made for 100 p.s.i. pressure drops. G. D. H.

68. The Restored State Method for Determination of Oil in Place and Connate Water. W. A. Bruce and H. J. Welge. *World Oil*, 4.8.47, **126** (10), 34.—See Abstract No. 1616 (1947).

69. Study of the Flow of Fluids through Ideal Porous Media. Part II. J. C. Calhoun, Jr., and S. T. Yuster. *Producers' Monthly*, July 1947, **11** (9), 25. (*Paper presented before A.P.I., Chicago*, Nov. 1946.)—Artificial porous bodies were used in the experimental investigations and the preparation of these is described. Measurements of liquid flow were made by two different methods. The first enabled absolute measurements of permeability to be made, whilst in the second method only relative measurements could be made. A description is given of the apparatus and procedure used in each case. A table giving data pertaining to the artificial porous bodies is presented, but no experimental results are presented in this part. R. B. S.

70. Phase Behaviour in the Methane–Ethane–*n*-Pentane System. G. W. Billman, B. H. Sage, and W. N. Lacey. *Petrol. Tech.*, July 1947, **10** (4), *A.I.M.M.E. Tech. Pubn. No.* 2232, 1–12.—The composition of the co-existing phases in the methane–ethane–*n*-pentane system has been determined at a temperature of 100° F, and pressures of 500, 1000, 1500, and 2000 p.s.i.a. Samples of the co-existing phases were withdrawn under isobaric–isothermal conditions and analysed by conventional fractionation methods.

The results are presented in tabular and graphical form. At particular pressures and temperatures the equilibrium constant of each component was affected significantly by the composition of the system, and this effect was more pronounced at the lower pressures for methane than for the other components. At the higher pressures approaching the maximum two-phase pressure for the system at 100° F the composition markedly influences the equilibrium constant of all the components. G. D. H.

71. Recent Progress in Secondary Recovery Research. R. V. Hughes. *Producers' Monthly*, June 1947, **11** (8), 14. (*Paper presented before Pennsylvania Grade Crude Oil Association, Pittsburg*, June 1947.)—Recent progress in water flooding and air–gas drive researches carried out by the Pennsylvania Grade Crude Oil Association is outlined. R. B. S.

72. Use of Explosives in Secondary Recovery. R. C. Earlougher. *Petrol. Engr. Reference Annual*, 1947, **18** (10), 174. (*Paper presented before A.P.I., Chicago*, Nov. 1946.)—The value of shooting operations in injection and producing wells in water-

flooding projects is discussed. It appears that, whilst it is absolutely necessary to shoot some sands, there are others where it appears that little benefit is to be gained by shooting. The necessity, or otherwise, of shooting, seems to depend upon the sand structure, and it is believed that, for sands that do respond favourably to shooting, with resulting increases in injection and production rates, flooding efficiencies can be increased by the use of selective or varied shots, dependent upon variations in permeability and oil and water saturation. R. B. S.

73. Use of Helium as a Tracer in Oil and Gas Fields. E. M. Frost. *Petrol Engr. Reference Annual*, 1947, **18** (10), 140. (*Paper presented before A.I.M.M.E., Galveston, Texas*, Oct. 1945.)—The use of helium as a tracer in oil and gas fields is discussed, and some field results obtained by using helium for this purpose are presented. A description is also given of a helium analysis apparatus developed by the U.S. Bureau of Mines and of other equipment necessary to carry out field experiments. R. B. S.

74. Potentiometric Model Studies of Fluid in Petroleum Reservoirs. B. D. Lee. *Petrol. Tech.*, Sept. 1947, **10** (5), *A.I.M.M.E. Tech. Pubn. No.* 2231, 1–10.—A simplification of Hurst and McCarty's method of conducting potentiometric model studies by the single-probe method is described. The tracing of the equipotential lines is made by a probe coupled with a pantograph to trace them directly on a map. Current lines are drawn at right angles to the equipotentials. Provided that the interval between the successive equipotentials is small the transit time between these is proportional to the squares of the separation. This step was executed by a special scale. Summation of these transit times gives the transit time between two points. This procedure greatly reduced the time involved in the studies.

Studies of certain idealized flow problems, such as may arise in the injection of gas into a condensate field, are described in some detail.

A new instrument is described for directly mapping flow lines. In place of a single probe four probes arranged in a cross are used. The cross is capable of swivelling about an axis through one of the probes. Two opposing electrodes are used to give the equipotentials and are connected with a small indicator which reads zero when the setting is correct; the other two electrodes then lie on a current line, and a potentiometer gives the potential drop between them.

Appendices give an analytical solution of certain flow problems and describe the electrolytic models employed. G. D. H.

75. Apparatus for Determination of Volumetric Behaviour of Fluids. B. H. Sage and W. M. Lacey. *Petrol. Tech.*, Sept. 1947, **10** (5), *A.I.M.M.E. Tech. Pubn. No.* 2269, 1–9.—Apparatus is described for determining the volumetric behaviour of hydrocarbons at pressures up to 10,000 p.s.i. and at temperatures between 0° and 460° F. Provision is made for the measurement of both total volume and liquid-phase volume. The procedure to be followed in using this equipment is described, and the estimated incertainties of the measurement are as follows: total volume, 0·5%; liquid volume, 0·005 cu. in.; temperature 0·2° F; pressure 0·2 p.s.i. or 0·15%; weight, 0·2%.

Diagrams show the general layout of the equipment, the details of construction of the level indicator, the equilibrium cell, pressure balance, magnetic agitator, and level indicator drives. G. D. H.

76. Use of Plastics in Consolidating Loose Sand in Wells. R. H. Smith and A. C. Polk. *Petrol. Engr, Reference Annual*, 1947, **18** (10), 177. (*Paper presented before Amer. Inst. Min. and Metall. Engrs., Galveston, Texas*, Oct., 1946.)—See Abstract No. 1417 (1947).

77. Radioactive Markers in Oilfield Practice. H. G. Doll and H. F. Schwede. *Petrol. Tech.*, Sept. 1947, **10** (5), *A.I.M.M.E. Tech. Pubn., No.* 2261, 1–10.—When thin beds are to be produced at considerable depths, there is a great need for accurate placing of the tools needed to put the well in production. Radioactive bullets are placed in the well wall before casing by a gun associated with an S.P. recording electrode and thereby the markers are in a known position relative to the electric log. It is preferable to set at least three spaced markers, because at times one is lost, and there is a possibility of movement, and this can generally be detected if the original spacings are

known. The markers are located by a specially designed detector which is run with the gun-perforating equipment. The position can be obtained accurately by traversing the hole at 1500 ft/hr in the section of interest. The gun is then placed with respect to these detected positions, and the overall accuracy of perforating is greatly increased. It is also customary to locate the casing collars in the same section. Examples of the use of radioactive markers are described. G. D. H.

78. Flood-Water Treatment in Eastern Kansas. C. L. Pate. *World Oil*, 22.9.47, **127** (4), 44.—Requisites of a flood-water are (1) eliminate plugging of pay sand; (2) will not react with formation water to precipitate solids; (3) retard or eliminate corrosion of lines. The chemical characteristics of various waters used in Eastern Kansas are tabulated. Points to be considered in water treatment are (1) samples of water and return salt water should be analysed; (2) treating plant should be designed to condition the water in question; (3) oil should be removed before mixing return salt water with raw flood-water; (4) water control tests should be made.

The methods of treatment for several waters and a flow-sheet of a typical water-treatment plant are given. The costs of chemical treatment for several waters are tabulated. C. G. W.

79. Higher Recoveries Indicated by Higher Pressure Gradients. R. V. Hughes. *Producers' Monthly*, July 1947, **11** (9), 8.—Owing to the controversy regarding the effect of pressure gradients in water-flooding operations, a study of this problem has been commenced by the Pennsylvania Grade Crude Oil Assoc'n. A few preliminary results are presented: these were obtained using a long core from the first Venango sand, and charging it with a known quantity of live Bradford crude (46·0° A.P.I. gravity crude charged at 20 p.s.i. with produced gas) and produced brine. These results show that, under the conditions of the tests which were believed to simulate those within the higher permeability sands of the Bradford–Alleghany area, there is a small but constant increase in recovery with increased pressures, especially at low pressures. The characteristics of the first Venango sand and the gradients and velocities used may not be representative of what happens in actual water floods of Bradford or other sands of low permeabilities. R. B. S.

Oilfield Development.

80. Significance of World Petroleum Production Trends. W. L. Baker and L. J. Logan. *Petrol. Tech.*, July 1947, **10** (4), *A.I.M.M.E. Tech. Pubn. No.* 2228, 1–10.—In 1950 or soon after facilities will be available in countries outside the U.S.A. for the production, transportation, and refining of about 4,305,000 brl/day of crude oil. The projected potential production is about 1,500,000 brl/day above the record-setting extra-U.S.A. production of 2,810,000 brl/day in 1946. The scheduled new foreign activities are equivalent to almost one-third of the present U.S. facilities.

The projected expansion appears to have been carefully planned on a sound business basis, with careful consideration of the world's needs. This additional oil will not flood world markets and disrupt the U.S. domestic industry. Even conservative estimates of both U.S. and extra-U.S. demands show that the increased extra-U.S. output can be absorbed and yet permit a continued rise in U.S. output. World consumption need rise only by 5·7% per year from 1947 to 1950 to utilize the projected output and such an increase is probable in view of past and current trends. G. D. H.

81. World Petroleum Output and Reserves Concentrated in Three Areas. Anon. *Oil Gas J.*, 22.11.47, **46** (29), 44.—The present world oil output rate is 52% above the 1938 level. Proven world reserves are estimated at 67,700,000,000 brl (U.S.A. 24,200,000,000 brl; Venezuela 7,500,000,000 brl; Middle East 26,600,000,000 brl; U.S.S.R. 5,700,000,000 brl).

The U.S.A., Venezuela, and the Middle East are responsible for practically all the rise in output and proven oil reserves since 1940.

So far as countries outside the U.S.A. are concerned they must look for an indefinite period to Venezuela and the Middle East for the bulk of their oil supplies. The reserves of these areas have been discovered, developed, and are now owned almost exclusively by nationals of the U.S.A., Britain, the Netherlands, and France.

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Post-war oil needs are greater than expected and transport is inadequate. Various pipelines are planned in the Middle East.

It is estimated that the 1947 oil consumption will be 580 gal/head in the U.S.A., 268 gal/head in Canada, 97 gal/head in the rest of the Western Hemisphere, and 16 gal/head in the Eastern Hemisphere (exclusive of U.S.S.R.).

U.S.A. has had a large increase in kerosine, diesel oil, furnace oil, and gas oil consumption since 1941. This is reflected in the percentage yields of products in the U.S.A. refineries for July 1941 and July 1947, which were respectively 44·2% and 40·6% for gasoline, 5·2% and 5·6% for kerosine, 13·4% and 16·3% for distillate (diesel, furnace, and gas oils), and 24·3% and 23·9% for residual. G. D. H.

82. 1947 Drilling Footage to Exceed all Past Record by Wide Margin. Anon. *Oil Gas J.*, 11.10.47, **46** (23), 124.—It is planned to drill 68,250,000 ft of hole in the U.S.A. during the second half of 1947, and this should give a total for the year of 121,526,000 ft, compared with 97,048,000 ft in 1946. The expectations in various major areas are discussed briefly and a table gives by States and districts the footage attained each year from 1940, with the predicted footage for 1947. G. D. H.

83. Future of Oil in West Virginia. P. H. Price, R. C. Tucker, and J. C. Martens. *Producers' Monthly*, July 1947, **11** (9), 19. (*Paper presented before Pennsylvania Grade Crude Oil Association, Pittsburgh*, June 1947.)—See Abstract No. 1559 (1947).

84. International News. Anon. *Oil Gas J.*, 1.11.47, **46** (26), 43.—Silvestre 2 in Western Venezuela is still under test, but will be completed as a producer.

In the second quarter of 1947 Peru produced 2,757,617 brl of crude, and had 3011 wells producing at the end of June. G. D. H.

85. Rising Production, New Refineries Top Venezuelan Development. Anon. *Oil Gas J.*, 25.10.47, **46** (25), 72.—Venezuela's oil output averaged 1,225,044 brl/day in the last week of August, and exports of refined products totalled 14,768,366 brl for the first 7 months of 1947. 502 wells were completed during the first 8 months of 1947, 466 giving oil and 5 gas.

Plans have been made for clearing part of the Maracaibo bar to permit the passage of ocean-going vessels. G. D. H.

86. Germany's Oil Industry To-day. Anon. *World Petrol.*, Oct. 1947, **18** (11), 46.—In 1946 Germany produced 642,438 tons of crude oil and in the first half of 1947, 274,602 tons. There are 23 active oilfields. 42,581 m of drilling was completed in the first half of 1947, and over half of the May and June drilling was exploratory.

Adorf, northwest of Lingen, is the latest oil discovery and produces from the Wealden at 1240–1340 m. The reserves are placed at 950,000 tons. The Emsland district has a proved reserve of 3,800,000 tons and a further probable reserve of 4,000,000 tons.

During 1946 Bentheim produced 106,000,000 cu. m. of gas. Its reserves are placed at 4,500,000 cu. m. Gas is obtained from the Reitbrock, Nienhagen, Steimke-Rodewald, Wesendorf, and Heide oilfields. During May together they gave 540,000 cu. m. compared with 6,000,000 cu. m. from Bentheim.

Gasoline and fuel oil form most of the imports, and there is much unused refinery capacity. G. D. H.

87. Indigenous Production in Russia Insufficient to Meet Demands. W. W. Burns. *Oil Gas J.*, 18.10.47, **46** (24), 86.—Russia's oil requirements may be 900,000 brl/day in 1950.

The Apsheron peninsula has provided 4,000,000,000 brl of Russia's 6,000,000,000 brl produced to date. In 1940 large numbers of wells in the Baku region were shut in awaiting pumping, air-lift, or gas-lift equipment, and over 1000 were being employed for secondary recovery work. These are indications that this area has passed its peak.

The Maikop region produced 50,000 brl/day in 1939 and 2000 brl/day in 1945; Grozny gave 45,000 brl/day in 1939 and 26,000 brl/day in 1945. The Ural–Volga (Second Baku) area gave 38,000 brl/day in 1939–40 and 57,000 brl/day in 1945. It is planned to produce 200,000 brl/day in 1950.

Russia has undertaken to supply some oil to Denmark and Italy. G. D. H.

Transport and Storage.

88. Sizing of Refinery Oil Lines. W. L. Nelson. *Oil Gas J.*, 18.10.47, **46** (24), 153.—No. 166 in the *Refiner's Notebook* series deals with considerations involved in the sizing of pipelines, including friction loss, cost of pumping and of installation, and costs related to large-diameter lines, such as heat losses, heavier walls, and insulations. Tables show the range of approximate economic capacity in brl/hr, and approximate pipe sizes for oil lines relative to viscosity at flowing temperature and gal/min.
G. A. C.

89. The "Biggest Inch". Anon. *Pipe Line News*, Oct., 1947, **19** (10), 10.—This article reviews the history of the California Section of this line. Difficulties encountered and the methods and equipment used to overcome such difficulties are described. The pipe is of all-welded construction, welds being examined by gamma-ray method. Compressor stations being installed on the pipeline are also mentioned. C. G. W.

90. Installation of Automatic Control on the Portland–Montreal Pipeline. Anon. *Petroleum Times*, 11.10.47, **51**, 1006.—The automatic control system which has been installed on the Portland–Montreal Pipeline is described. The advantages of automatic control are: (1) the prevention of contamination of various grades of crude oils; (2) the ability to maintain a controlled suction pressure to the pumps; (3) the limitation of maximum discharge pressure; and (4) simplification of operators' and dispatchers' work.
R. B. S.

91. Modern Oil Tankers. R. Hammond. *Petroleum*, July 1947, **10**, 146.—This article commences a series dealing with the evolution of the oil tanker.
Historical development, steam vessels, propelling machinery, wartime developments, and modern trends are discussed in detail. Of particular interest is the decision to replace one of the Diesel prime movers in a tanker by a gas turbine. A diagram of a B.T.H. 1200-h.p. gas-turbine unit is given.
F. W. H. M.

Refinery Operations.

Cracking.

92. Gas Oil Polyforming. W. C. Offutt, P. Ostergaard, M. C. Fogle, and H. Beuther. *Oil Gas J.*, 27.9.47, **46** (21), 80.—A brief comparison of thermal cracking and polyform process operations on residual oils and virgin gas oil is given. In thermal cracking, high oil recycle ratios are required for maximum gasoline yields and relatively low octane number gasolines are produced (65–70 A.S.T.M. from paraffinic type gas oils) and relatively large amounts of tars are formed. In the early days of polyforming practice a moderate liquefied gas dilution of 40–75% on the feed stock was used and this operation was followed by the cracking of the recycle stock with 72–100% gas dilution. The temperatures and pressures employed were not much higher than for thermal cracking, but the combined treatments produced higher yields and higher octane number gasolines (A.S.T.M. 70–74 from paraffinic stocks) than thermal operations gave. Present-day single-pass polyforming technique shows greatly improved results have accrued from the use of the more severe cracking conditions which are permitted by using gas dilutions of 150–300% of the feed, viz. increased yields of, and greater octane value gasolines (*i.e.*, 73–77 A.S.T.M. and 84–88, research method from paraffinic type stocks, and 76–82 A.S.T.M. from naphthenic type gas oils and light catalytic recycle feeds). A flow diagram of gas oil polyforming is given and the operating conditions and data from polyforming operations with the gases from the gas oil itself, and with extraneous gases, are discussed. Two ways are described for stabilizing the gasoline: (*a*) to produce a maximum yield of gasoline by controlling the volatility to *ca.* 10 R.V.P. and recycling the excess C_4 hydrocarbons; (*b*) to recover a maximum yield of the C_4's containing a high concentration of olefins in addition to debutanized gasoline. Gas oils which tend to coke at moderate conversions without

gas dilution give increasingly higher yields of gasoline when polyformed with increasingly greater gas dilutions.

Products from the cracking of the oil in polyforming operations are formed in the presence of reactable hydrocarbons, and there is a tendency to promote thermal alkylation, thermal polymerization, and other addition-type reactions between them. The maximum gas dilutions obtainable without the use of extraneous gases depend upon the boiling range and the characterization factor of the feed stock. Wide boiling-range virgin gas oils give enough C_3 gases on cracking to allow maximum dilution (*ca.* 300%) in polyforming. Light virgin gas oils and light recycle stocks give only sufficient for 200% dilution. Very refractory cycle stocks give only 150–175% for diluting the feed stock. The effects of gas dilution and of boiling range are discussed, and data are given in graphs and tables for a very wide range of polyforming operations. In addition to light and wide range virgin gas oils the data also cover polyforming of catalytic cycle stocks, from paraffinic, intermediate, and naphthenic sources, by means of their own cracked gases and plus propane-propylene and butane-butenes from outside sources. W. H. C.

93. High-Temperature Thermal Cracking of Petroleum Fractions. H. H. Heilman. *World Petrol.*, 1947, **18** (12), 86–88.—Methods in use are based on the Ugite process. Charging stocks have principally been reduced crudes or S.R. naphthas and gas oils. Temperatures in the checker brickwork generator shells may vary between 1200 and 1900° F at a pressure slightly above atm. Residence times range from below 1 sec to several min. Operations in the Los Angeles plant of the S. California Gas Co. are described. Using a residence time of 1 sec (at 1300° F) high butadiene yields were obtained starting from S.R. naphthas. The effluent gases pass through a water wash-box, the heavy liquid hydrocarbons and water being separated prior to dehydration and distillation. The gases are compressed to 200 p.s.i. and then pass through an oil absorber and stripper train. Residue gas, after removal of butadiene and partial removal of ethylene and propylene, is rich in hydrogen and methane and also contains ethane and some olefins. It is available for fuel. The recovered heavy oil is highly aromatic and furnishes materials for use in the synthetic rubber, aviation gasoline, resin and chemical industries. E. B.

Polymerization.

94. Friedel–Crafts Catalysts in Polymerization. R. G. W. Norrish and K. E. Russell. *Nature*, 1947, **160** (4068), 542–543.—The velocity of polymerization of *iso*butene in the presence of boron trifluoride is measurable at −140° C, and the concentration of catalyst required can be reduced to 0·006% by repeated purification of the reactants. Measurable rates are also obtained with stannic chloride as catalyst and ethyl chloride as common solvent at − 78·5° C. In this system the rate of polymerization of *iso*butene is found to be directly proportional to the amount of added water up to 0·43%. Concentrations of stannic chloride up to 1·25% induce rapid increases in polymerization rate, but with higher concentrations the rate increases only gradually. These facts can be explained by assuming that a soluble hydrate functions as the active catalyst; at very low concentrations of stannic chloride an insoluble hydrate with no catalytic activity is formed.

The polymerization rate is a maximum at an *iso*butene concentration of 30%, but since the dielectric constant of the system changes rapidly with monomer concentration no quantitative measure of rate variation can be given.

The addition of ethyl and *tert.*-butyl alcohols, diethyl ether, and acetone in the presence of 0·18% water reduces the rate to less than a fifth of its normal value, and there is no reaction when water is absent. 1- and 2-butene at concentrations of 2 and 6% reduce the rate by half. The rates of polymerization are markedly accelerated in the later stages of reactions with < 0·05% added water, and this effect is thought to be associated with an increase in the viscosity of the medium.

In explanation of these facts, a mechanism which involves a chain reaction initiated by charged ions derived from hydrated stannic chloride and terminated by mutual neutralization, is suggested. H. C. E.

Isomerization.

95. Catalytic Dehydrogenation of Ethylbenzene (1). Chemical Equilibrium in Styrene Formation from Ethylbenzene at Low Pressure. J. C. Ghosh, S. R. D. Guha, and A. N. Roy. *Petroleum*, June 1947, **10**, 127.—The considerable industrial uses of styrene renders the economical production of the following compounds important: ethylene from alcohol, ethylbenzene from benzene, and ethylene and styrene from ethylbenzene by dehydrogenation. Theoretically, the reaction

$$C_6H_5CH_2CH_3 \rightleftharpoons C_6H_5CH = CH_2 + H_2$$

is reversible, and should therefore make possible the determination of the equilibrium constants. These data, together with specific heat equations, can then be used to evaluate the various thermodynamic characteristics of the reaction.

In the dehydration of alcohol to form ethylene, aluminium hydroxide (12·5%) precipitated on kaolin (87·5%) proved a far more powerful catalyst than either alumina or kaolin alone; the optimum temperature was 420° C, giving a 92% conversion of alcohol and 99% of ethylene in the reaction product.

In the formation of ethylbenzene from ethylene and benzene according to Reid's method, a higher reaction velocity was obtained when 1% of Raney nickel was added to the aluminium chloride.

The dehydrogenation of ethylbenzene to styrene was accomplished using a catalyst (A) containing Cr_2O_3 (70%), Al_2O_3 (15%), and Cu (15%) yielding 48·5% of styrene at 600° C. Ethylbenzene diluted with carbon dioxide in the ratio of 1 : 2 (mols) gave a constant yield of 45% styrene at 600° C over catalyst (B) of composition Cr_2O_4 (80%), Al_2O_3 (5%), Fe_2O_4 (15%).

An apparatus is described for the determination of the equilibrium conditions of the dehydrogenation reaction at pressures between 10 and 50 mm and in the temperature range 360–500° C using catalyst (A). F. W. H. M.

PRODUCTS.

Chemistry and Physics.

96. Structure and Diamagnetic Susceptibility of *cyclo*-Octatetraene. R. C. Pink and A. R. Ubbelohde. *Nature*, 1947, **160** (4067), 502.—The molecular susceptibility of liquid *cyclo*-octatetraene at 20° C, $-51{\cdot}9 \times 10^{-6}$ C.G.S. units, indicates that its structure corresponds with a cyclic system of conjugated single and double bonds, and not with one of equivalent C–C bonds (see Abstract No. 1493 (1947)). That the colour of the solid changes from yellow to white at low temperatures may indicate a change in bond structure. H. C. E.

97. Infra-Red Spectrum of Ketene. F. Halverson and V. Z. Williams. *J. Chem. Phys.*, 1947, **15**, 552–559.—The infra-red spectrum of ketene has been studied from 2·5μ–25μ with a spectrometer using LiF, NaCl, and KBr prisms, the presence of diketene formed by dimerization being corrected by following the changes over a period of hours. All fundamental vibrational frequencies have been assigned.

The general molecule H_2XYZ has been given a normal co-ordinate treatment and reasonable force constants for ketene calculated. D. F. J.

98. Thermal Properties of *cyclo*Pentane and its Use as a Standard Substance in Low-Temperature Thermal Measurements. G. J. Szasz, J. A. Morrison, E. L. Pace, and J. G. Aston. *J. Chem. Phys.*, 1947, **15** (8), 562–564.—The heat capacities of *cyclo*-pentane as determined in the Penn state adiabatic calorimeter B^1 are in satisfactory agreement, under normal operating conditions above 30° K, with results obtained elsewhere. D. F. J.

99. Heat Capacity of Benzene Vapour. The Contribution of Anharmonicity. D. W. Scott, G. Waddington, J. C. Smith, and H. M. Huffman. *J. Chem. Phys.*, 1947, **15** (8), 565–568.—The heat capacity of benzene vapour was measured in the range 68–198° C, and values of Cp°, the heat capacity in the ideal gas state, were obtained. By assuming

a moderate degree of anharmonicity of the vibrations, excellent agreement was obtained between values of $Cp°$ calculated statistically from spectroscopic data, and the observed values. An empirical equation for the second viral coefficient of benzene vapour was obtained from the observed values of $\left(\frac{\delta Cp}{\delta P}\right)_T$ and heat of vaporization, and the Antoine equation for vapour pressure. D. F. J.

100. Equilibrium Atom and Free Radical Concentrations in CO Flames and Correlation with Burning Velocities. C. Tanford and R. N. Pease. *J. Chem. Phys.*, 1947, **15** (7), 431–433.—Calculations are made of equilibrium concentrations of OH radicals, H atoms, and O atoms in moist CO flames. On comparing these with burning velocities measured by Jahn, close correlation is found to exist only with the H atom concentrations. D. F. J.

101. Adsorption Isotherms for Mixed Vapours of Carbon Tetrachloride and Methanol on Activated Charcoal at 25° C. W. B. Innes and H. H. Rowley. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1154–1171.—By use of the method described the composition of the adsorbed phase is kept constant, and the total press and composition of the vapour measured. The quantity adsorbed when the surface is "completely covered" has been determined as a function of the mol fraction of the adsorbate. From the adsorption data, partial and total spreading pressures have been calculated. The results have been discussed from the kinetic, molecular and thermodynamic standpoints. D. F. J.

102. Adsorption Equilibria of Liquid Mixtures of Carbon Tetrachloride–Methanol with Charcoal. W. B. Innes and H. H. Rowley. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1172–1181.—Selective adsorption has been evaluated using a derived relationship between selective adsorption and the magnitude and composition of the adsorbate, and mixed-vapour adsorption isotherms. The selective adsorption has also been determined using a relationship derived from the Gibbs adsorption equation. The values obtained by these methods for the system CCl_4–CH_3OH adsorbed on charcoal have been compared with values obtained by direct measurements, reasonable agreement being obtained. D. F. J.

103. Solubilization by Solutions of Long-Chain Colloidal Electrolytes. R. S. Stearns, H. Oppenheimer, E. Simon, and W. D. Harkins. *J. Chem. Phys.*, 1947, **15** (7), 496–507.—The solubilization of various hydrocarbons in solutions of potassium laurate and potassium myristate is studied. The extent of solubilization is found by use of the turbidimetric method, a photometer being used to determine the turbidity.

Increase in the concentration of the soap does not increase the solubility of an oil above that in water, until the critical concentration for the formation of micelles is attained. Above this the solubility, designated as solubilization, increases. It appears that for a homologous series of oils the solubilization is dependent upon the molar volume, and that generally the polarity and shape of the oil molecule have some effect. The addition of salts increases the solubilizing power of the soap. D. F. J.

104. Size and Vibration Frequency of the Excited Benzene Molecule. V. Griffing. *J. Chem. Phys.*, 1947, **15** (7), 421–429.—It is shown theoretically that the change in size and vibration frequency of a polyatomic molecule upon electronic excitation can be calculated if the excitation energy is known as a function of the distance. This is applied to benzene, for which the function is calculated by two methods. Comparing with experiment, it is found that both methods give the right sign and order of magnitude for the change in size, but the wrong sign for the change in frequency. D. F. J.

105. Theory of Burning Velocity. I. Temperature and Free Radical Concentrations Near the Flame Front, Relative Importance of Heat Conduction and Diffusion. C. Tanford. *J. Chem. Phys.*, 1947, **15** (7), 433–439.—An investigation is made of the relative importance of heat conduction and diffusion in establishing concentrations of H atoms near the flame front. Differential equations set up for heat and material

transfers are solved for two mixtures, one containing moist CO and the other H_2. It is shown that the temperature falls rapidly as the distance from the flame front increases and that the local thermal equilibrium concentration of H atoms falls more rapidly. However, the local non-equilibrium concentration of H atoms which is caused by diffusion falls only slowly with distance. It is concluded that diffusion plays a more important part than heat transfer. D. F. J.

106. Dielectrics and Rheology of Non-Aqueous Dispersions. A. Voet. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1037–1063.—The variations in the dielectric constant of a dispersion (ε) with the concentration of the dispersed phase have been investigated at rest and when subjected to varying shearing stresses. ε has been related to the shape of the dispersed particles by means of a form factor, and changes in ε with shearing stress have been related to particle agglomeration and orientation. The agglomeration factor is indicative of the forces acting between the particles of the dispersion, and the index of deflocculation indicates the dispersing power of a vehicle. D. F. J.

107. Effects of Temperature upon the Critical Concentrations of Anionic and Cationic Detergents. H. B. Klevens. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1143–1154.—The method depends upon the fact that certain dyes have totally different spectra in polar and non-polar solvents and the dye in the presence of soap micelles shows essentially the spectra of the dye in a non-polar medium.

Increase in temperature causes an apparent decrease in the critical micelle concentration (*cmc*) of soaps and detergents, this apparent decrease being due to changes in dye aggregation. Values of *cmc* determined by this dye method are smaller than those determined by either conductivity or refraction. D. F. J.

108. Phase Behaviour of Sodium Stearate in Anhydrous Organic Solvents. G. H. Smith and J. W. McBain. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1189–1204.—The phase behaviour of anhydrous systems of sodium stearate and twelve hydrocarbons are studied by visual observation. All phase changes are reversible and obey the phase rule. The phase diagrams are very similar for all the hydrocarbons. The diagrams for toluene and *cyclo*hexane are drawn and show the five phase regions which are characteristics of the whole set. D. F. J.

109. Dispersions of Extraneous Materials in Asphaltic Bitumen. F. J. Nellenstein. *Ingenieur*, 21.11.47 (47), M.89–91.—When dilute solutions of bitumens in xylene (1 to 5000) are observed under the ultramicroscope the number of particles per cc are as follows: Trinidad epuré, 406; Asphaltic bitumen plus clay, 170; Asphaltic bitumen plus basic copper carbonate, 1085–2858; Asphaltic bitumen plus copper sulphate, 204; Asphaltic bitumen plus iron sulphate, 19; Gilsonite plus basic copper carbonate, 101.

The maximum particle size in bitumen obtained as a residue from vacuum distillation is 6 m μ; that obtained from atmospheric distillation, especially the harder grades, 0·1 μ.

The author puts forward the following theories: (*a*) asphaltic bitumen consists of micelles containing inorganic salt kernels; (*b*) asphaltic bitumen contains methylenic groups, bitumen from coal-tar containing acetylenic groups. N. C.

110. An Electrical Study of Boundary Lubrication. Anon. *Aircr. Engng*, Sept. 1947, **19**, 294.—This enquiry into "boundary lubrication" by means of observations on electrical breakdown phenomena has given very strong evidence in favour of the idea that oil films of this kind possess appreciable thickness. I. G. B.

111. Determination of Vapour Pressures Below 10^{-3} mm Hg. S. F. Kapff and R. B. Jacobs. *Rev. sci. Instrum.*, 1947, **18** (8), 581–584.—In a novel method of vapour-pressure measurements on substances of low volatility, vapour from the liquid boiling at low pressure is directed on to a metallic mirror, and conditions are adjusted so that the spot of condensed liquid remains constant in size. In these circumstances the condensed liquid is in a state of dynamic equilibrium dependent on the boiler and mirror temperatures, both of which can be measured; and the ratio of vapour pressures at boiling surface and mirror can be calculated. If a single value of the vapour pressure in this region is known by other methods, the absolute pressure at any temperature can be found.

For several pure compounds results agree with those obtained by a tensimeter method, but are lower than results obtained by the use of ionization gauges. This is attributed to inherent limitations in the use of the latter. It is claimed that the results are accurate to 30%, whereas other methods give errors of several hundred % in this pressure region. H. C. E.

Analysis and Testing.

112. Carbon–Hydrogen Ratio. Simplified Combustion Calculations for Petroleum Fuels. H. R. Linden. *Fuel Oil & Oil Heat*, Sept. 1947, **6** (5), 72.—This paper is a review and summary of an article on "Combustion Calculations for Hydrocarbon Fuels" by the author and D. G. Othmer, published in *Chemical Engineering* for April and May 1947. A new empirical correlation is described which is based on the use of the C/H ratio in relation to the A.P.I. gravity, and the following A.S.T.M. data: the aniline point; the 50% b.p.; and the 10–90% distillation slope. For petroleum fractions boiling from 300–800° F, the accuracy is estimated to be within 3% maximum error and 1% arithmetic average error. A simplified correlation between the Diesel index (0·01 × A.P.I. gravity × A.S.T.M. aniline point), the 50% b.p., and the C/H ratio of commercial fuel oils and related petroleum fractions is also reported. Both these correlations are based on the correlation of Cauley and Delgass (see Abstracts Nos. 1132 (1946) and 1499 (1947)). The paper here abstracted gives a table relating to heating values of fuel oils and pure hydrocarbons to C/H values of from 6·0 to 10·0, and a nomograph for the determination of Stack losses of hydrocarbon fuels (reproductions of Table II and Fig. 4 in the original paper), and discusses their application. The correlation and nomographs presented in the original article are recorded. The nomographs to correct for temperatures and humidity of air supply and for temperature of the entering fuel are particularly useful for heat-balance calculations for pre-heated air and pre-heated fuel and steam atomization. This integrated system of combustion calculations based on the C/H ratio and latest spectroscopic and thermochemical data is applicable to all hydrocarbon fuels burned under normal conditions, and has the advantage that for most liquid hydrocarbons the ratio can be obtained by a simple empirical method. The temperature range is sufficiently wide for the correlation to be used in efficiency calculations for jet engines and gas turbines and also for calculating flame temperatures. W. H. C.

113. Infra-Red Absorption Analysis of Gases and Vapours. 4. Technique of Limited Radiation Analyses. K. Quarendon. *Petroleum*, July 1947, **10**, 159.—Precautions to be taken in using analysers are described and humidity considerations when using rock-salt prisms discussed. Conditions capable of control which may be adjusted to suit each component are detailed. Method of making an analysis and the effect of interfering absorptions are given. F. W. H. M.

114. Demonstration of Some New Methods of Determining Molecular Weights from the Data of the Ultracentrifuge. W. J. Archibald. *J. Phys. Coll. Chem.*, 1947, **51** (5), 1204–1214.—Theories are developed to enable measurements of mol. wt. to be made without equilibrium being attained in the ultracentrifuge. D. F. J.

115. Lime–Soda Softener Control. (Refiner's Notebook No. 161.) W. L. Nelson. *Oil Gas J.*, 13.9.47, **46** (19), 117–118.—Titration with sulphuric acid is described as a means of estimating the amount of soda ash and lime required to treat boiler feed-water. Details are given for making up standard solutions and indicators and for determination of total hardness by a soap titration.

The article includes two charts, which may be consulted to decide whether the amounts of lime and soda being used should be increased or decreased and by how much. One example is given and worked out in full. W. M. H.

116. Study of Reaction Intermediates by Means of a Mass Spectrometer. G. C. Elteton. *J. Chem. Phys.*, 1947, **15** (7), 455–481.—**I. Apparatus and Method.**—A method is described for coupling a reaction chamber to a Dempster-type mass spectrometer in such a manner that shortlived intermediates can reach the electron beam. The presence of radicals is denoted by an increase in the ion current of the corresponding

mass, excited molecules not being in sufficient quantity to affect the change. Although the method has limitations with regard to sensitivity and calibration, it has extended more than tenfold the pressure range in which radicals are detectable, thus bridging the gap between mirror and spectroscopic methods so that low-pressure combustion phenomena may be studied.

II. Thermal Decomposition of Some Lower Hydrocarbons.—The intermediates occurring during the decomposition of methane, ethane, propane, propylene, butanes, butylenes, oxygen, and nitric oxide with and without lead tetramethyl and in demethyl ether and diazomethane have been surveyed semi-quantitatively using the method described in Part I. Methyl radicals were detectable, and a qualitative study was made of the interaction of methyl and various gases. H atoms and ethyl radicals have been found, but refinements in technique will be required before these and heavier radicals can be studied systematically.

III. Low-Pressure Flames.—Using the method described in Part I, a survey has been made of the intermediates formed during the combustion of CH_4, C_2H_2, and CO at pressures from 30 mm to 140 mm. By following their intensity changes, the intermediates may be assigned to zones or phases in mechanically-oscillating and pulsating-flow flames. The intermediates HO_2, CH_2O, CH_2O, CHO, C_2H_2, and CH_3 were detected, the temperature coefficients of CH_2O, CHO, and HO_2 being negative and of CH_3 positive. CH_3 is a chemical intermediate and is not attributable to the thermal decomposition of CH_4. It is not yet possible to say whether an intermediate of mass 16 in a propane–oxygen flame is CH_4 or atomic oxygen. D. F. J.

117. The Mass Spectrometer in Gas Analysis. Anon. *World Oil*, 22.9.47, **127** (4), 43.—The applicability of the mass spectrometer to gas analysis is discussed. The results of a co-operative analysis of a standard sample of natural gas by the mass spectrometer and chemical methods are presented as a frequency–distribution plot. The plot shows the necessity for standardization of procedure in gas analysis. C. G. W.

118. New Fischer Techniques for Studying Oils and Waxes. A. H. Bigelow. *Chem. Eng. News*, 1947, **25**, 2366–2367.—Characterization of waxes into isomeric monocyclic and polycyclic types is obtained from a tetragonal diagram having as ordinates weight percentage, molecular weight, and a classification number. The latter is obtained as the product of the difference of the sp. gr. and melting point of the sample and the corresponding data for the equimolecular *n*-paraffin.

Quantitative estimation of occluded oil in paraffin wax is determined by a microscope slide count of oilspots in a sample of wax dyed with an oil soluble dye. The dye is insoluble in wax crystals.

Rapid estimation of solid paraffin wax in oils and wax cakes by an electro-optical method can be made by quantitative measurement of polarized light transmitted through a coated slide, oils being isotropic and waxes doubly refracting. Calibrations against prepared standards are made.

The correlation found between filterability of a filter medium and electrostatic charge has considerable implication in dewaxing processes. E. S. E.

Crude Oil.

119. Composition and Properties of Petroleum in West Virginia. A. J. W. Headlee, R. E. McClelland, and H. A. Hoskings. *Producers' Monthly*, June 1947, **11** (8), 18.—Extensive tabulated data is presented of the composition and properties of 158 samples collected from individual wells in West Virginia. The results obtained are discussed. R. B. S.

Engine Fuels.

120. On the Tendencies of Various Fuels to Self-Ignition at a Hot Point. R. Vichnievsky. *C.R. Acad. Sci (Paris)*, 1947, **225**, 565–567.—A single-cylinder variable-compression engine was used to study pre-ignition, using an electrically-heated filament mounted in the combustion chamber as an artificial hot-spot. The relative pre-ignition tendencies of different fuels were evaluated in terms of the electrical energy

required to provoke inflammation of the charge in advance of the spark-initiated normal combustion process. The formation of a secondary flame front by pre-ignition was detected electrically, using an electrode located near the heated filament.

At fixed engine speed, compression ratio, mixture inlet temperature, and mixture strength, the relative pre-ignition tendencies of the fuels tested *decrease* in the following sequence: methanol, acetone, *n*-heptane, benzene, *iso*-octane, xylene; the latter requiring the largest power input into the heated filament. At a fixed mixture strength, etc., the energy input required for pre-ignition decreases with increasing compression ratio and the curves obtained with the above fuels are all of the same form, with the exception of acetone, for which the variation with compression ratio is less marked. For a given fuel at fixed compression, ratio and mixture strength, the energy required for pre-ignition varies with engine speed and for the stoicheiometric mixture passes through a minimum, and also decreases with increasing mixture inlet temperature.

Engine speed has a very marked effect on the energy input required to give pre-ignition. For the majority of fuels this energy increases with increasing speed. Of the fuels examined Saint Gaudens gasoline is the most sensitive in this respect, but methanol shows practically no variation. The pre-ignition characteristics of a fuel can be matched by a mixture of xylene and methanol of the appropriate composition and these two fuels can be used to establish a pre-ignition scale, in which methanol performs a similar function as *n*-heptane does in the knock-rating scale. G. H. B.

Lubricants.

121. Limits to the Thickness of Liquid Films. Relation Between the Viscosity and the Minimum Thickness of Liquid Films. A. Marcelin. *C.R. Acad. Sci* (*Paris*), 1947, **225**, 225–226.—An oil of medium viscosity spreads under slight pressure to form a liquid film of minimum thickness 1–2 μ (many times greater than molecular dimensions) which can support pressures up to 100 kg/cm^2 or more without destruction, while maintaining fluid lubrication essentially without friction. At higher pressures this "minimum liquid film" is broken and the limiting surfaces come into pseudo-contact, separated by a "stratofilm" a few molecules thick which still facilitates relative movement but with higher friction.

The breakdown of the minimum liquid film is initiated at the irregularities of the limiting surfaces and its stability increases as the rate of sliding is decreased, also with increasing oil viscosity and improved surface finish. The stratofilm may be compared with the "black spot" region of a soap bubble and the minimum liquid film with the soap bubble proper. The thickness of the minimum film when loaded to the point of destruction may be measured by means of a "microfilm meter" which is briefly described. The ability to form liquid films of minimum thickness is shown by all viscous materials and is a manifestation of molecular association.

Data are given for six oils of common origin with viscosities ranging from 37 to 3500 cs at 15° C, for which the thicknesses of the minimum liquid films are shown to be directly proportional to the square roots of the viscosities. The minimum film thicknesses observed were $0{\cdot}15$–$1{\cdot}2 \times 10^{-4}$ cm. G. H. B.

Special Hydrocarbon Products.

122. Synthetic Fatty Acids. Anon. *Industr. Chem.*, 1947, **23**, 652–656, 755–763.—A review of the fatty acid situation in Germany during the war. Manufacture of synthetic fatty acids in Germany never exceeded 100,000 tons/year and the four plants (Witten-Ruhr, Ludwigshafen-Oppau, Heydebreck, and Magdeburg) never operated at capacity. In addition, fatty acids of high mol. wt. were produced at Sterkrade-Holten by Ruhrchemie, primarily for the purpose of making montan wax substitutes. Fischer–Tropsch (F.T.) fatty acids were also recovered. In the Ruhrchemie process the wax, heated to 125° C, was reacted in an enamelled iron kettle with nitrosyl-sulphuric acid, the proportions of wax and acid being 75 kg to 15 litres (sp. gr. 1·9). Nitrous gases (containing 8% NO_2) were bubbled through at 65 m^3/hr. About 50% of the wax could be economically oxidised. The product was washed free from

sulphates and the acids saponified with 30% strength caustic alkali solution, the temperature being maintained at 100° C to remove the water. Unchanged wax was then extracted with F.T. spirit (b.p. 80–100° C) and re-cycled. The recovered acids were yellow-brown and had a solidifying point of 80° C, acid val 145–150, sap. val. 150–155, and iodine val 0. The Witten plant processed F.T. gatsch in 10 and 20 ton capacity aluminium towers 9 m in height. Air was bubbled through a perforated false bottom, the wax being held at 100–120° C, until 30% of the wax was oxidized. Potassium permanganate (0·1–0·2%) was used as catalyst; the duration of the process was 10–30 hr. C_1–C_{10} acids were recovered from the gaseous products, the higher mol. wt. acids were saponified and centrifuged to remove much of the wax. Most of the remaining hydrocarbons were separated in autoclaves at 150–180° C and 20–25 atm pressure. The lower layer contained 45% soap and 15% gatsch, which latter was finally removed by flash evaporation with steam. The acids liberated from the sodium soaps were distilled at 3–5 mm, yielding fractions suitable for soap and margarine manufacture. Details are given of other plants, together with running costs, and the costs, biological effects, and uses of synthetic fats are discussed. E. B.

123. Toxicants in Oils for Control of the Citrus Blackfly. C. C. Plummer and J. G. Shaw. *Economic Entomology*, Aug. 1947, **40** (4), 499.—An efficient spray for the practical control of the citrus blackfly, *Aleurocanthus woglumi* Ashby, became necessary owing to the failure of its important parasite, *Eretmocerus serius* Silv., to control it in certain parts of Mexico. Exploratory studies in Cuernavaca, Morelos, Mexico, on the control of the blackfly included eleven applications in one year of kerosene and spray oil emulsions, with and without small amounts of D.D.T.; four monthly applications of tank-mix oil, and four monthly applications of kerosene and spray oils containing dibutyl phthalate in which derris extractives were dissolved. All these insecticides were effective to a certain extent at the low concentrations tested.

Further field tests on Mexican sour-lime trees were performed in Cuernavaca with higher concentrations of oil applied at higher pressures. Preparations containing 1·67% of light-medium emulsive oil with benzene hexachloride, chlorinated camphene, chlordane, and Lethane 60 at the rate of 0·9 oz of toxic element per gal of oil were not so effective as derris powder in oil containing 0·225 oz of rotenone per gal of oil. This combination of oil and derris was especially toxic to the pupae.

A second and similar experiment with 1·67% of light and light-medium emulsive oil, with and without cube dust (5% rotenone) at the rate of 3 oz and also 4·5 oz per gal of oil, confirmed results of the previous experiment in showing the value of adding rotenone-containing dusts to oil.

Another experiment gave additional data on the toxicity of derris dust in oil and also demonstrated the effectiveness of 3% kerosene–xylene emulsion containing D.D.T. at the rate of 1·67 lb in 100 gal of emulsion. The application of 15 lb of 40% water-dispersible DDT in water to make 100 gal resulted in a marked reduction in blackfly population. G. A. C.

124. Dielectric Strength. Results of Service Tests for Acid in Insulating Oil. W. H. Blunt. *Elect. Times*, 1947, **112**, 657–658.—Experimental curves are given relating acid value of insulating oil with % loading, for both steel kiosk and brick sub-stations. In the former (average loading 80% of maximum) the mean acidity was 5·8 mg KOH/g, whilst for brick ventilated sub-stations (average loading 85% of maximum) it was only 0·89. Acid values in excess of 2 mg KOH/g cannot be accepted as safe. Transformer sizes ranged from 100 to 500 kVA and the average age of the oil was fourteen years. V. B.

Derived Chemical Products.

125. A Simple Method for the Preparation of Carbon Monoxide in the Laboratory. G. Jacini. *Chim. e Industria*, 1947, **29** (8–9), 204.—Carbon monoxide may be simply prepared in the laboratory by the action of formic acid on acetic anhydride in the presence of a trace of sulphuric acid as catalyst. The reaction takes place in the cold. D. H. McL.

Miscellaneous Products.

126. Chemicals from Petroleum. E. R. Smoley, R. M. Torrey, and L. Kniel. *World Petrol.*, 1947, **18** (12), 78–81.—Production of chemicals from petroleum is described from the point of view of the output of existing and proposed plants. Methods of cracking for olefins and separation of the gaseous products are briefly outlined and costs discussed. Total production of chemicals from petroleum in the U.S.A. rose from 150,000 lb in 1925 to 4×10^9 lb in 1946. A large proportion of the country's organic solvents is already being manufactured from petroleum, viz., ethanol 50%, *iso*propyl alcohol 100%, acetone 75%, *n*-butyl alcohol 35%, amyl alcohol 90%. Synthetic detergents from petroleum now exceed 250 million lb/year. Much of the expansion in the production of chemicals from petroleum is due to increasing costs and shortages of other raw materials. E. B.

127. Synthesis of Butadiene from Ethyl Alcohol. Thermodynamic Considerations and the Comparative Behaviour of Catalysts. G. Natta and R. Rigamonti. *Chim. e Industria*, 1947, **29** (8–9), 195.—Processes for the production of synthetic rubber from alcohol have received wide application in Russia and also in the U.S.A., where during the war 40% of total production was by this method. The hardest problem to be solved was that of the form of catalyst to be used. A review is given of published work (mainly American) on this subject, while work carried out by the present authors is also described. D. H. McL.

128. Industrial Uses of Oxygen. M. H. Caron. *Ingenieur*, 31.10.47, (**44**), M51–56.—A review of the various manufacturing processes of oxygen together with costs is given.

The paper then describes various processes in which oxygen can be used: (1) the production of high calorific gas from coal; (2) the production of synthetic organic acids and alcohols; (3) the oxidation of ammonia, sulphur dioxide, and the partial oxidation of organic compounds; (4) roasting of sulphides, including pyrites; (5) the use of oxygen in the Bessemer and Siemens Martin processes for steel production; (6) the production of high temperatures by burning combustible material in oxygen; (7) the use of oxygen in the Fischer–Tropsch, Lurgi and Bergius processes leading to the production of petroleum products; (8) its use in the underground gasification of coal for the production of petroleum and chemical products.

Ideal diagrammatic flow sheets of items 7 and 8 are given. N. C.

129. Polyvinylidene Chloride. Part II. Characteristics, Fabrication, and Application. J. P. Standinger. *Brit. Plastics*, Oct. 1947, **19** 453.—Vinylidene chloride polymers and copolymers are odourless, tasteless, non-toxic, and non-inflammable. Those properties are valuable, but the greatest advantage of this material over other thermoplastics is that it exists in a crystalline as well as an amorphous state. This fact necessarily affects its mechanical properties and the methods of manufacturing mouldings and extrusions from it. The polymer is in the amorphous state at about 150° C and this state can be maintained for a period of time by rapid chilling. This property is very valuable since, in the amorphous state, the polymer is soft and rubbery and can easily be processed, after which it gradually crystallises, during which time its physical and mechanical properties, *e.g.*, hardness, density, electrical properties, etc., undergo marked changes and a typical X-ray diffraction pattern develops. In addition to this the effect of orientation (*i.e.*, subjection of plastic materials to unidirectional stress so that the polymer chains tend to fall into parallel alignment, thus increasing the tensile strength) is more pronounced than is the case with most plastic materials. The marked effect of this operation is also responsible for the low water penetration of the material. Polyvinylidene chloride tends to be unstable to light, and at temperatures above 150° C it undergoes thermal decomposition with the evolution of hydrochloric acid. The use of stabilizing agents is therefore required, particularly in view of corrosion difficulties which might arise in manufacture and storage. Higher boiling-point liquids are most useful in this respect since if they exert a plasticising influence they have the added advantage of allowing processing at lower temperatures. The most widely used of these is di(phenylethyl) ether or its nuclear chlorinated or hydroxylated derivatives.

Methods of fabrication similar to those in general use in the plastics industry can be used in connexion with polyvinylidene chloride though with certain modifications, and in some cases specialized manufacturing methods have been adopted, in order to take full advantage of the unique properties of the material. In all cases much stricter temperature control than is usual is required.

The outstanding properties mentioned above make the application range of polyvinylidene chloride very wide and, considering all the various fabrication methods possible, this may be exemplified by its use in pipelines for corrosive liquids and as a packaging material for the preservation of machinery and foodstuffs. O. M.

Engines and Automotive Equipment.

130. A Fuel System Full-Scale Testing Rig. Anon. *Airc. Engng*, 47.11.47, **19** (225), 340.—The considerable difficulties encountered in designing a test rig which would allow of unbroken fuel supply from tanks whose attitude was being changed continuously was successfully overcome.

The fuel system as designed, based on the principle of the transfer of fuel by air pressure from subsidiary tanks to a central delivery tank, proved quite satisfactory. The performance of the electrically driven booster pumps installed in the delivery tank was approved both as regards high altitude delivery and ability to maintain a continuous supply to the engine during aerobatics.

Inward venting and air transfer pressure control proved troublesome with the equipment available, and special valves were designed, made, and tested to overcome the difficulties. The effect of dissolved air in the paraffin fuel was investigated, and found to be less serious than was at first anticipated.

The work as a whole confirmed the previously formed opinion that full-scale rig testing of this type is an invaluable aid to efficient design. I. G. B.

131. High-Temperature Alloys. Anon. *Flight*, 30.10.47, **52** (500).—This is a review of metallurgical problems of gas-turbine performance defining the terms used in assessing the performances of these alloys. Nimonic 75 in sheet form is virtually standard for combustion chambers and other components, and since 1942 Nimonic 80 has remained the standard material for aircraft turbine blades in this country. I. G. B

132. Gas Turbine Topics. Anon. *Oil Engine & Gas Turbine*, Oct. 1947, **15**, 195.—*Water-cooled Blade Research.* Water-cooled rotor blades, designed by Dr E. Schmidt, of L.F.A., Braunschweig, have been constructed using ordinary mild steel and easily obtainable ceramics. The cooling water is pumped through the hollow shaft of the turbine rotor, and enters three small radial holes in each rotor blade. These holes extend nearly to the tip of the blade.

During rotation, strong convection currents are set up owing to centrifugal forces and variations in density caused by temperature differences. The water thus flows outward along the cylindrical surface and inward along the cylinder axis. The steam which forms at the outlet end of the hollow rotor shaft is led to a small auxiliary steam turbine, and is condensed and returned to the cooling cycle.

With this system, it is possible to operate at an entry gas temperature of 1200° C, which is about 700° C higher than the usual maximum.

Lightweight Heat Exchangers of Small Bulk. A heat exchanger designed by Dr Ritz, of A.V.A., Goettingen, improves aircraft gas turbine efficiency by removing heat from the exhaust gases, and feeding back as much as possible into the air leaving the compressor prior to combustion. The system designed is primarily adapted to gas turbines delivering shaft power.

The exchanger consists of a circular ceramic cylinder in two parts, connected by seals, which rotates at approximately 30 r.p.m. about its axis, and through which hot and coal gases pass alternately in a radial direction. Considering one element in the lower chamber of the cylinder, hot exhaust gases flow through this element and raise the temperature of the ceramic. Rotation speed is adjusted so that when the latter temperature equals the turbine gas temperature, the exchanger element in question passes through the seal into the upper chamber, through which the cool compressed air flows. Thus, as the element reaches the second seal, it has given up nearly all its excess heat to the air, and is practically at the latter's temperature. C. D. B.

MISCELLANEOUS.

133. Interim Report on Coal Utilization. Anon. *Heating Ventilating Engr*, Aug. 1947, **21** (242), 62.—Report was submitted on June 27 by the Chairman of the Parliamentary Scientific Committee.

One of the proposals of the Report was generous spending on the importation of oil, as the shortage of a few million tons of coal last winter lost us £200,000,000 of exports. Fuel oil consumption in this country for year ended April 1946 was 2,000,000 tons. Schemes of conversion equivalent to another 6,000,000 tons only will be approved, making a total of 8,000,000 tons. The Report suggests further investigation into the possibility of increasing and improving the present schemes, *e.g.*, converting more of the boilers in our power stations to oil firing. It advocates encouraging all who have, or can get, diesel generators, to use them to the maximum extent possible. Additional overall economy could be effected if conversion schemes which had not enabled fuel oil to show up to the best advantage were cancelled and replaced by others in which oil can effect a greater economy. Some conversions were permitted when we were more concerned with the urgent need of saving coal than with the combining of such saving with advantageous and economic use of oil fuel. In some industries, steel ceramics, etc., oil fuel can be used to great advantage.

At least 8–9 million tons of oil fuel could be imported, with permanent economic advantage, to replace coal even if coal supplies were abundant. This figure does not include the use of oil for diesel engine locomotives (the advantages of which have already been proved) or for use in gas turbines. D. W. J.

134. United Kingdom Petroleum Trade in 1947 : Details for August and the Eight Months. Anon. *Petrol. Times*, 27.9.47, **51**, 961.—Tables are presented of U.K. imports and exports of crude oil and refined for August and the first eight months of 1947. Comparative tables for 1946 are also presented. R. B. S.

135. United Kingdom Petroleum Trade in 1947 : Details for September and the Nine Months. Anon. *Petrol. Times*, 8.11.47, **51**, 1104.—Details are given of U.K. imports and exports of crude oil and refined products for September and the first nine months of 1947, together with comparative figures for the corresponding periods of 1946. R. B. S.

136. Entry of U.K. Oils by Ports in War and Peace. Anon. *Petrol. Times*, 11.10.47, **51**, 997.—A statistical survey is presented of pre-war and post-war oil imports by ports. This shows that throughout the war period imports into the west coast ports have increased, whilst imports into the east coast ports have decreased. R. B. S.

137. United States Petroleum Industry in the First Half-Year of 1947. Anon. *Petrol. Times*, 27.9.47, **51**, 954.—Details are given of U.S. crude production by States and principal fields for the first half of 1947 and the corresponding period of 1946. A table showing output, imports, exports, demands, and stocks of petroleum products is also presented. R. B. S.

BOOKS RECEIVED.

Rinehart's Yearbook 1947. Tulsa, Oklahoma: Rinehart Oil News Co., 1947. $10.

An exhaustive account of oilfield operations and new discoveries in the U.S.A. during 1946. Details of discovery and extension wells are given.

Drilling and Production Practice 1946. New York: American Petroleum Institute, 1947. Pp. 414.

Contains selected papers on drilling and production practice read before various meetings of the Division of Production during 1946. A blibliography of all papers read in 1946 is appended.

Proceedings of the Institution of Mechanical Engineers. Vol. 155, War Emergency Issues 13–24, 1946. London: Institution of Mechanical Engineers, 1947. Pp. 471 + xi.

Among the papers included in this volume are: "An Exploratory Study of Oil Grooves in Plain Bearings" (D. Clayton); "Fluid Film Lubrication of Parallel Thrust Surfaces" (A. Fogg); "An Analysis of the Lubrication between the Piston Rings and Cylinder Wall of a Running Engine" (J. S. Courtney-Pratt and G. K. Tudor); "Some Notes on Mechanical Factors Affecting Ring Gumming in Petrol Engines with Particular Reference to the Rating of Lubricating Oils" (B. Pugh); "Experiments in the Reproducibility of Engine Conditions for Ring-Sticking Tests in a Single-Cylinder Petrol Engine" (G. S. Cantle).

Journal of the Iron and Steel Institute. Vol. CLII, 1946. London: Iron and Steel Institute, 1947.

Included in this volume is a symposium of papers on fuel efficiency in iron and steel works, with a report of the discussion thereon.

Catalytic Chemistry. H. W. Lohse. New York: Chemical Publishing Co., 1945. Pp. 471 + xiv. $8·50.

The five chapters are headed: (I) Brief History of Catalytic Chemistry, (II) Catalytic Theory, (III) Nature and Properties of Catalysts, (IV) Specific Types of Catalytic Reactions, (V) Industrial Catalytic Reactions.

Natural Gas and the Public Interest. F. F. Blachly and M. E. Oatman. Washington, D.C.: Granite Press, 1947. Pp. 159 + viii. $1.

Physical Chemistry and the Technology of Fuels. A. W. Gauger. Pennsylvania State College, 1947. Pp. 114.

This is the 21st Annual Priestley Lecture and has been expanded by the addition of some background material about fuels. "A review of the present state of our knowledge of fuels with particular emphasis on these aspects that are of interest to physical chemists."

German and Japanese Intelligence Reports.

B.I.O.S.

952. Design Investigation in Selected German Consumer Goods Industries. Pp. 155.
1210. Chemisch—Physikalische versuchs Anstalt der Marine—Fuels, Lubricants, and Organization. Pp. 31.
1391. Development of Loop-scavenged Two-cycle High-speed Compression Ignition Engines of Small Bore. Pp. 35.
1492. German Scientific Films. Pp. 36.
1558. German Acetylene Chemical Industry. Pp. 73.

1575. Carbonyl Nickel and Carbonyl Iron Powders, their Production and Properties. Pp. 35.
1576. Manufacture of Saccharin and its Intermediates at I.G. Farben Factories. Pp. 13.
1597. Phthalic Anhydride Manufacture in Germany. Pp. 69.
1602. Manufacture and Applications of Vinyl Alkyl Ethers, Acrylates, their Polymers and Co-polymers. Pp. 104.
Miscellaneous 41. German Naval Fuel Oil. Pp. 19.

J.I.O.A.

1. German Underground Installations. Part 1—Unique Design and Construction Methods.
2. ——. Part 2. Adaptations of Existing Facilities.
3. ——. Part 3. Various Installations of General Interest.

F.I.A.T.

623. Ignition Apparatus for Engines Operating on Heavy Fuel Oil. Pp. 7.
729. German High-Temperature Coal-Tar Industry. Pp. 163.
874. Manufacture of Ethylene Oxide via Chlorohydrination of Ethylene. Pp. 51.
1000. The Oxo Process. Pp. 76.

B.I.O.S./J.A.P./P.R.

826. Research on Rocket Fuels of the Hydrogen Peroxide-Hydrazine Type. Pp. 112.
914. Fundamental Hydrocarbon Research. Pp. 98.
922. Naval Research on Alcohol Fuel. Pp. 180.
1305. Progress in the Synthesis of Liquid Fuels from Coal. Pp. 308.

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OILFIELD EXPLORATION AND EXPLOITATION.

Geology.

138. Analytical Geology. S. I. Tomkeieff. *Nature*, 1947, **160** (4076), 846 (*Summary of five articles by A. B. Vistelius in C.R. (Doklady) Acad. Sci. U.S.S.R.*, 1944–47).—In an application of statistical analytical methods to numerical geological data, a study is made of the porosity of oil-bearing strata in the Transvolgian region of the U.S.S.R. The coefficients of porosity (y) of the rocks, when plotted against the depth (x) below

a certain stratigraphical horizon, yield an equation containing four constants, which can be evaluated. The analogous coefficients for different observations are then compared and plotted on a geographical map by means of isopleths. These isopleth maps are found to be analogous to certain geological maps, from which it is deduced that the distribution of porosity not only obeys a periodic law, but is also related to the geological history of the rock formation. This in turn is stated by Vistelius to be indicative of the processes which were involved in the laying down of the strata, and as such may have a very wide applicability to geological problems. In the case discussed the porosity of the rocks has a direct bearing on the distribution of reservoir beds in the oilfield. H. C. E.

139. Anadarko Basin Gets Deep Production. Anon. *Oil Gas J.*, 15.11.47, **46** (28), 359.—A producer has been completed in NW SE 4-4n-5w, Grady County, southeast Oklahoma. A drill-stem test at 13,634–13,875 ft in the Simpson sand flowed 436 brl/day of 48° crude with a G.O.R. of 3500–2800 on a ¾-in choke. The well is on the west plunging zone of the Pauls Valley uplift.

The Hunton was topped at 12,494 ft, Sylvan at 12,796 ft, Viola 13,015 ft, Bromide dense 13,480 ft, Bromide dolomite at 13,560 ft, and first sand at 13,644 ft.

G. D. H.

140. Few Dry Holes at Dollar Hide. C. J. Deegan. *Oil Gas J.*, 15.11.47, **46** (28), 338.—Dollar Hide has 16 Devonian wells and 2 Silurian producers. The field is in southwest Andrews County, Texas, near the New Mexico State line.

The Devonian pay is about 100 ft thick and 8000 ft deep; the closure may be 800 ft. There may be a fault on the east or south of the producing area. All the good Silurian shows have been near the top of the structure. Oil has been found in the Ellenburger. Nine wells have had favourable drill-stem tests in the Wichita–Albany.

The Devonian does not thin markedly on top of the structure. The Ellenburger pay may be 200 ft thick; it is below 10,000 ft.

Some of the wells have been acidized. Devonian wells cost about $90,000; Silurian wells cost $125,000; dual completions cost $135,000. G. D. H.

141. Exploration Play in Western Canada Calls Attention to Area's Potentialities. N. Williams. *Oil Gas J.*, 15.11.47, **46** (28), 192.—About twenty areas in south and east Alberta have yielded oil, but at present only eight, besides Turner Valley, produce regularly. Development has generally been restricted to the Lower Cretaceous and Madison, but both the Ellis and the Devonian have proved productive at several places and offer definite oil potentialities through the area. The Ellis produces at Conrad and in the Dunmore gas field; the Devonian produced some oil and gas at Princess–Steveville, and is important at Leduc. Except at Turner Valley, the producing horizons exploited are generally shallower than 4000 ft.

Leduc is 200 miles from the nearest oilfields, except for the Viking gas field 150 miles to the east. 23,000,000 acres have been leased in this area, and tests are being drilled on fifteen blocks within 75 miles of Leduc. The main objective is the Devonian which produces at depths of 4500–5400 ft at Leduc. Leduc has 18 producers, and the area is not yet defined. The daily output is 1100–1200 brl.

A number of tests are being drilled in the foothills belt. The third well at Jumping Pound is 14,443 ft deep and has penetrated 238 ft into the Cambrian. Two earlier wells have found wet gas in the Madison.

The Lloydminster field extends for 30 miles and produces from Lower Cretaceous sands at depths of 1800–2000 ft. Daily output from 130 wells is about 3200 brl of 10°–18° oil. G. D. H.

142. Greenland, Arctic Canada, Oil Discoveries Reported. Anon. *Oil Gas J.*, 15.11.47, **46** (28), 194.—Evidences of oil are said to have been discovered on Nugsuak Peninsula in Greenland, and on Peary's Land, Arctic Canada. G. D. H.

143. Second Oil Well in Chile's Springhill Field may Prove Equal to Discovery. Anon. *World Oil*, Oct. 1947, **127** (6), 252.—Springhill 7 is Chile's second oil well. The discovery well was estimated to be capable of flowing 1500 brl/day initially, and might have a settled production of 300–700 brl/day.

Two dry holes and 3 gas wells have also been completed. It is believed that there is a central gas cap surrounded by a ½-mile wide oil belt. The field may have 20–30 oil locations, and could perhaps give 7000–10,000 brl/day. The gas is rich in condensate.

Another structure may be tested about 100 miles west of Springhill. G. D. H.

144. Petroleum Geology [in Germany]. W. Rühl. *Nature*, 1947, **160** (4073), 724 (*Meeting at Hanover*, Sept. 1947).—Exploration of 26 German oilfields has provided much geological and geophysical information. The Zechstein Mesozoic rocks are thought to be the main source rocks of German oil, but other formations are of considerable account. Almost all the fields are poor in gas content and subject to edge-water drive. In 1946 the total production was about 4,380,000 brl.

Geophysical results were obtained from the destruction of fortifications on Heligoland; and other reports dealt with geophysical and petrographic methods of investigation, production engineering, and micro-palæontology. H. C. E.

Drilling.

145. Development of Edeco Rock-bits. Anon. *Petrol. Times*, 6.12.47, **51**, 1208.—The development of the manufacture of rock-bits in Britain, culminating in the formation of a group of American specialists working with the English Steel Corporation, is outlined. The processes involved in manufacture are briefly mentioned. C. G. W.

146. Automatic Drilling Control. M. E. True and R. R. Crookston. *Oil Gas J.*, 1.11.47, **46** (26), 70.—Drilling rate studies stress the importance of controlled weight on the drill-bit. Feed with a hand-brake is irregular, and an automatic mechanism—walking feed-off air brakes—is here described. The method consists of an air system that actuates the brake bands, and a closed hydraulic system that operates right and left brakes alternately during drilling. When the brakes are set for feeding off the drilling line, rotation of the brake drum is regulated by the closed hydraulic system, rate of feed-off being determined by an adjustable choke. Apparatus for automatic control provides a means for (1) actuating the hydraulic feed-off orifice valves on a hydraulic feeding device; (2) taking weight given by the weight indicator to control the feed-off mechanism; (3) stop feed-off when the weight on the bit reaches a certain maximum value; (4) shifting automatic control from weight to drill-pipe torque when the torque reaches a predetermined value.

Such apparatus and means of control are fully described. C. G. W.

147. Mobile Drilling Platforms for Offshore Exploration. E. Short. *Oil Gas J.*, 22.11.47, **46** (29), 55.—Mobile drilling platforms have considerable economic possibilities and two outstanding designs are available. One consists of a drilling platform 240 ft by 120 ft supported 44 ft above two submersible pontoons. The platform is supported by 100 tubular columns, through which piling can be driven, and sixteen wing towers 14 ft in diameter, which give stability and depth control when the pontoons are flooded. The second type has a drilling platform 190 ft by 80 ft, supported on two hulls. The structure is stabilized by mud ballast compartments located in the ends of the hulls and on the centre line of each side. Stability during sinking is obtained by stabilizing columns built on the hulls. The mud ballast compartments are filled from barges.

Although not yet perfected, these designs offer a mobility which is necessary for economic offshore drilling. C. G. W.

148. Handling Mud in South Texas. N. Williams. *Oil Gas J.*, 6.9.47, **46** (18), 73.—In South Texas, gas cutting and salt-water dilution make it difficult to condition mud in the time allowed for recirculation. Use of steel tanks instead of pits reduces contamination and seepage losses, and greater capacities allow greater storage volumes of conditioned mud for emergencies, and greater time for conditioning return mud. One existing large mud system uses three steel tanks, interconnected so that any or all can be cut out of the system and used for storing, mixing, or conditioning mud.

Tanks are equipped with submerged rotating mud guns, which prevent settling of mud materials and assist release of entrained gas.

Pump capacities and pressures, and well protection against blow-outs are briefly mentioned. C. G. W.

149. Reverse Circulation. G. Weber. *Oil Gas J.*, 8.11.47, **46** (27), 70.—The principal object of reverse circulation has been to obtain large cuttings. The method is more successful in hard formations and hence it is desirable to be able to change the direction of flow simply.

To allow pressure to be applied to the casing annulus, blow-out preventers and strippers may be used. Since these are designed for heavier duty than normally encountered in reverse circulation drilling a packing device has been developed. This consists of a mandrel with joint connexions at either end which transposes both downward and return streams to the annulus. Between the ports, a flexible packer turns against the casing. Pressure fluid enters the annulus below the packer and return fluid flows into the annulus above the packer. A basket for small fishing jobs with reverse circulations is also described. The main hazard of reverse circulation is mud loss. This is reduced by lowering pump pressures, and conditioning and use of additives.

The use of reverse circulation requires enlarging of the mud courses, and possibly modification of drilling procedure. C. G. W.

150. Factors Affecting True Formation Resistivity. S. J. Pirson. *Oil Gas J.*, 1.11.47, **46** (26), 76.—Apparent resistivity is a function of lithology and fluid content. Waters contained in rocks and soils are described and classified. Equations for the resistivities of homogeneous sands, saturated with fluid, are derived for cubic, rhombic, and hexagonal packing. For unconsolidated sands, Sundberg's formula $\rho_o = \rho_w \frac{3}{\phi}$ may be used, where ρ_w is the resistivity of fluid content and ϕ = porosity. To this should be applied a correction factor for cementation m. Curves relating formation factor, cementation factor, and porosity are presented whence $\rho_o = \rho_w F = \rho_w \phi^{-m}$.

Factors affecting the resistivity of connate fluids are discussed, and curves of resistivity of connate water versus bulk salinity as a function of temperature are presented.

Effects of surface conductance, variation in fluid resistivity, and variation of saturation on experimentally determined resistivities are discussed. The relation of saturation to resistivity, *i.e.*, resistivity (partial saturation)/resistivity (100% saturated) is plotted graphically. Thus if we can obtain a value for the true resistivity we can obtain the water saturation of the rock in place. 10 references are appended.

C. G. W.

151. Factors Affecting Measured Apparent Formation Resistivities. S. J. Pirson. *Oil Gas J.*, 22.11.47, **46** (29), 63.—Factors influencing the departure of apparent resistivity from true resistivity are, presence of well fluid of resistivity ρ_m, presence of possible well-fluid invaded zone, resistivity ρ_1, electrode configuration and formation thickness. This article studies the effects of electrode spacing and formation thickness. First, the theory of potential distribution in stratified media is developed for the two media case and then applied to all cases of two, three, or four electrode systems. The equations derived permit the calculation of resistivity curves, plots of $\frac{x}{a}$ versus $\frac{\rho_2}{\rho_1}$, where x = distance of the current electrode from the boundary and a = electrode spacing. $\frac{\rho_2}{\rho_1}$ is the resistivity ratio of the two media. In order to derive the true resistivity we assume that the resistivity curves due to two neighbouring boundaries are additive. Then assuming that the electrode spacing is known and formation thickness obtained from the self-potential curve, the apparent resistivity curves are superposed on the actual resistivity log and the standard curves that fit both sides of the log determined. These give the resistivity ratios of the media concerned. Checking this method by Resistivity Departure Curves showed that this is a rapid procedure for obtaining a first approximation to the true resistivity. Several references are appended. C. G. W.

Production.

152. Safety Knock-off Device. N. Williams. *Oil Gas J.*, 6.9.47, **46** (18), 97.—Details are given of a new knock-off arrangement which can be safely and simply operated.
C. G. W.

153. Engineering Fundamentals, Nos. 300 to 309. J. C. Calhoun. *Oil Gas J.*, 20.9.47, **46** (20), 319; 27.9.47, **46** (21), 113; 4.10.47, **46** (22), 103; 11.10.47, **46** (23), 207; 18.10.47, **46** (24), 157; 25.10.47, **46** (25), 125; 1.11.47, **46** (26), 91; 8.11.47, **46** (27), 89; 15.11.47, **46** (28), 347; 22.11.47, **46** (29), 97.—These are the first in a series of short articles dealing with the behaviour of fluids and applications to petroleum production;

(300) Behaviour of gases. (301) Standard calculations for gases. (302) Pseudo-critical temperatures of gases. (303) Specific gravity correlations. (304) Application of gas behaviour to reserve estimates. (305) Reservoir volumes. (306) Example of reserve estimates by gas law. (307) Solubility of gas in crude oil. (308) Change in oil volume with gas solution. (309) Reservoir volumes. Space occupied by stock tank oil and original gas.
C. G. W.

154. Application of Shaped Charge Process to Petroleum Production. R. H. McLemore. *Oil Gas J.*, 15.11.47, **46** (28), 261.—The penetrating effect of high explosive charges with a cavity in the forward end has been known for some time. The characteristics of penetration may be altered by placing a liner into the hollowed portion of the charge. Greatest penetration is effected by a conical liner of steel or copper. An approximate theoretical interpretation of the process is given. The process results in the formation of a jet, travelling at high velocity, which forms the hole, followed by the remainder of the liner, compressed to an elongated shape travelling at a much lower velocity. This process may be applied to casing perforation, open-hole blasting and formation penetration. Two sizes of charges have been developed for casing perforation. A 24-shot carrier has ports for the jets placed on 3-in centres at 120° phasing. The charges are inserted and aligned. Detonation is effected by a primer cord detonating fuse and electric blasting cap. The charges will penetrate casing and 6–9 in of cement. There is no tendency for the cement to crack or shatter. Requirements of explosive for charges for this purpose are (1) insensitive to shock; (2) high rate of detonation; (3) high energy content; (4) will burn without detonating; (5) will withstand temperatures of 325° F for 24 hr and 350° F for 1 hr.

The application of the process to open-hole blasting is also discussed in brief.
C. G. W.

155. Flow Meter for Measuring Input to Water Injection Wells. E. T. Young and O. L. Patterson. *Oil Gas J.*, 1.11.47, **46** (26), 60.—In cases of gravity water injection, used where an upper water sand is available, a means of metering the flow of water through the bore-hole is required. Regulation of flow is then accomplished by orifice chokes.

A new meter has been designed for this purpose. The metering element is a vertical shaft impulse turbine. Speed of revolution is linearly related to flow rate. A spring is compressed through a 1000–1 gear reduction from the turbine wheel and periodically released by a stepped cam. This drives a hammer against an anvil tightly coupled to the end of the sucker rods supporting the assembly. At the surface, acoustic impulses are converted into electrical impulses by an piezo-electric crystal. Amplified impulses are applied to a counter circuit actuating a five-digit counter. Calibration is necessary to convert counter readings into fluid quantities.

Further points of interest are an oil–water seal which provides a frictionless packing and equalizes internal and external pressures, and a clearance between turbine wheel and housing, to prevent jamming by sand.
C. G. W.

156. Water Locator Used in Peruvian Basin. L. S. McCaslin. *Oil Gas J.*, 6.9.47, **46** (18), 77.—Use of electrochemical apparatus to locate points of water entry is discussed. In a survey of 24 wells, water was reduced or shut off in 17, 5 could not be located, 1 was located, but plugging was not a success, and in 1 plugging was only partially successful.

The principle of the apparatus is that of the simple cell. Dilution of the electrolyte surrounding two dissimilar electrodes reduces the e.m.f. at a certain dilution, an abrupt drop in e.m.f. occurs. Equipment used consists of (1) electrode assembly; (2) electric cable and ruling mechanism; (3) indicating meter, which shows the nature of the fluid in which the electrode is immersed. Survey procedure consists of (1) preliminary conditioning; (2) introduction of electrolyte; (3) actual survey.

After (3) has been done, the well is produced for a short time and the selected part of the well traversed to determine points of water entry. Results of a number of surveys are given. C. G. W.

157. Results of Water Injection in East Texas. W. S. Morris. *Oil Gas J.*, 15.11.47, **46** (28), 245.—The East Texas oilfield is a monoclinal type structure. The oil-producing formation exists as a continuous interconnected porous zone, average porosity 25% and an average permeability of about 2500 md. The field is a water drive and large quantities of water were produced with the oil. Disposal of this water earlier presented a problem, which was finally overcome by injection into the reservoir. The benefits of this salt-water disposal programme in maintaining reservoir pressure are shown by statistics. To combat corrosion by salt-water, gathering lines are made of asbestos-cement, pressure lines are lined with plastic or cement, and pumps constructed of special alloys. Water is aerated, treated by chlorine, lime, and alum and is settled for 24 hr, then filtered before injection. C. G. W.

Oilfield Development.

158. West Texas–New Mexico Permian Basin Oilfields. H. H. King and G. M. Wilson. *World Oil*, Oct. 1947, **127** (6), 271.—The fields are listed alphabetically under alphabetically arranged countries with information on the mode of discovery, discovery well, type of structure, producing formation, producing area, cumulative production, number of wells, oil gravity, the deepest test, oil outlet, and main leaseholders. G. D. H.

159. Western Canada Oil Boom. C. O. Nickle. *World Oil*, Oct. 1947, **127** (6), 242.—Princess is a large gas reserve which promises substantial oil production. The Viking–Kinsella gas reserve covers 300,000 acres. Pakowki is a gas discovery, and so also is Manyberries to the east. Turner Valley is Canada's main field. Jumping Pound is a large gas reserve.

During the past decade over $50,000,000 has been spent on oil and gas exploration in western Canada. Early in 1947 the most encouraging results were obtained and activity has increased. Eight producers with potentials of 1000–2000 brl/day have been completed at Leduc. All have gas/oil ratios of 350–600 and are restricted to 100–250 brl/day. The proven area is 4 miles long and about 2 miles wide. There are two producing zones in the Devonian. The lower zone appears to be a reef, and the upper zone a porosity pinch-out. Producing depths are 5000–5400 ft. The Lower Cretaceous rests on the Devonian. The Viking sand of the Upper Cretaceous has gas, and the Lower Cretaceous has some light oil.

12°–19° crude has been found in the Lloydminster district over an area 27 miles long and up to 10 miles wide. Production is from the Lower Cretaceous at 1700–2000 ft, where there are interbedded sands and shales. The average initial output is 50 brl/day.

Tables show the Leduc and Lloydminster outputs by months for the earlier part of 1947. G. D. H.

Transport and Storage.

160. Viscosity and Centrifugal Pumps. W. L. Nelson. *Oil Gas J.*, 25.10.47, **46** (25), 129.—No. 167 in the *Refiners' Notebook* series gives data on viscosity and centrifugal pumps. A figure shows estimation of behaviour of a centrifugal pump when handling a 2000-viscosity oil, and four tables give performances for 60, 70, 80, and 90% maximum efficiency pumps, tabulating viscosity at pumping temperature, capacity, head, efficiency, and horse-power. G. A: C.

161. Contribution to the Study of Evaporation Losses and to the Choice of Storage Tanks. G. Daric. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 275–287.—The causes of evaporative losses, both "static" due to breathing, and "dynamic" due to filling, are considered. The value of the Reid v.p. is discussed and it is pointed out that this criterion is only strictly applicable when a tank is one-fifth full. A straight-line chart is given relating the v.p. to the temperature for hydrocarbons in the range C_3 to C_9. The thermal energy balance of storage tanks and the factors governing choice of tankage are reviewed. The following general cases are considered in some detail, the treatment being based on published American data: volume of vapour-saturated air corresponding to the loss by evaporation of unit volume of liquid; limiting filling height of an initially empty constant volume tank prior to vapour loss through the safety-valve; loss on the complete filling of a constant volume tank fitted with a release valve set at a given figure; reduction of filling loss by interconnection of tanks; daily breathing loss from a constant volume tank fitted with a release valve set at a given figure; reduction of evaporation loss by floating roof or connexion to a gas holder. V. B.

162. Automatic Control on Portland–Montreal Pipeline. C. Batchelder and R. Rockwell. *Pipe Line News*, Nov. 1947, **19** (11), 4.—See Abstract No. 90 (1948).

Refinery Operations.

Solvent Extraction and Dewaxing.

163. Solvent Extraction of Vegetable Oils. S. E. Tray and C. W. Bilbe. *Chem. Engng*, May 1947, **54** (5), 139.—Although the extraction of vegetable oil with chemical solvents presents no great difficulty on a laboratory scale, this cannot be said of the process when used on the industrial scale. Each material processed has different characteristics necessitating special treatment, and experience is the most valuable asset in such cases. The design of the plant to cover all these factors is of paramount importance. O. M.

Cracking.

164. Simplified Catalytic Cracking Unit. Anon. *Refiner*, Sept. 1947, **26** (9), 120–121.—Although there is nothing novel about the basic principle of Aurora Gasoline Co's catalytic cracking unit at Detroit, its advantage is in its simplified mechanical arrangement of equipment. The reactor is located immediately above the regenerator and the whole assembly is structurally equivalent to a large fractionating tower. O. M.

165. The Fluid Solids Technique: Applications in the Petroleum Industry. E. V. Murphree, E. J. Gohr, and A. F. Kaulakis. *J. Inst. Petrol.*, 1947, **33**, 608.—The basic principles of the fluid solids technique, as developed by the petroleum industry in the fluid catalytic-cracking process are described. Three specific applications of the technique are discussed, namely, the catalytic processing of gas oils, the extraction of liquid fuels from shales, and the synthesis of higher hydrocarbon homologues from natural gas. A. R. W. B.

Polymerization.

166. Polymerization of Olefins by Friedel–Crafts Catalysts. A. G. Evans, G. W. Meadows, and M. Polanyi. *Nature*, 1947, **160** (4077), 869.—Acetic acid acts as a co-catalyst with boron trifluoride in the room-temperature gas-phase polymerization of *iso*butene (see also Abstract No. 877 (1947)). A crystalline complex can be prepared by mixing acetic acid vapour with excess BF_3 gas, and the introduction of these crystals into *iso*butene results in rapid polymerization, which occurs entirely on the surface of the complex. It is deduced that the action of the co-catalyst is that it forms an addition complex, which then loses a proton to the *iso*butene, thus forming a carbonium ion which can initiate a polymerization chain. H. C. E.

Chemical and Physical Refining.

167. Where Does the Sulphur Go? M. J. Fowle and R. D. Bent. *Oil Gas J.*, 15.11.47, **46** (28), 209.—Information on the distribution of sulphur for various types of petroleum processing is presented. The types considered range from the simplest thermal cracking operation to a more complex combination of distillation, desulphurization, thermal viscosity breaking, gas-oil cracking, reforming, and catalytic cracking. The information given is based on processing of a collection of crude oils known as West Texas–New Mexico crude. Some twenty figures show the distribution of sulphur in products obtained in the various processes. For example, in the case of crude oil cracking, the figure (8) shows that a large proportion of the sulphur in recycle gas-oil cracking remains in the fuel. G. A. C.

Metering and Control.

168. Automatic Control of Refinery Operations. W. S. Ault. *J. Inst. Petrol.*, **33**, 598.—Instruments for the automatic control of refinery operations are considered from the viewpoint of the user. Their design or how they operate is not considered, but stress is laid on the capabilities of the instruments and the means by which they can be made to give the best results. A. R. W. B.

169. Product Pipeline Metering Practices. M. J. Dabney. *Oil Gas J.*, 15.11.47, **46** (28), 216.—Conditions, recommendations, and practices for the operation of positive displacement meters, and cost of replacement parts are discussed. All metering equipment described is rated at 150 p.s.i. maximum pressure. Accuracy of 0·05% is attained provided certain conditions, such as freedom of product from foreign matter, flow rates within, accuracy range of instrument, and avoidance of pulsating flow, are met.

Recommendations include adequate filtering equipment, recalibration of meters for products of different gravity, and automatic temperature compensation.

Master meter-proving supplements the prover tank method, and test data indicate that the two methods are equally accurate. The optimum life of a 6-in meter, with consistent accuracy in 4,000,000 brl, for a 4-in meter 2,000,000 brl, is quoted.

G. A. C.

PRODUCTS.

Chemistry and Physics.

170. X-Ray and Chemical Studies of the Catalysts Used in the Production of Butadiene from Alcohol. G. Natta and R. Rigamonti. *Chim. e Industria*, 1947, **29** (10); 239–243.—The production of butadiene from ethyl alcohol, using catalysts on a silica and magnesia base, gives a yield varying from 40% to 62% of theory, depending on the method of preparation of the catalysts and on their treatment. X-ray studies and chemical analysis have demonstrated that these remarkable variations are related to the formation of a silicate of magnesium, which alters the activity of the catalyst, lowering the yield of butadiene. Consequently a method of preparation of the catalyst has been adopted which reduces the formation of silicate and improves the yield.

D. H. McL.

171. The Ten Dimethylnaphthalenes, Their Physical Properties, Molecular Compounds, and Ultra-Violet Spectra. A. S. Bailey, K. C. Bryant, R. A. Hancock, S. H. Morrell, and J. C. Smith. *J. Inst. Petrol.*, 1947, **33**, 503.—The synthesis of the ten dimethylnaphthalenes is described and for each hydrocarbon the picrate, the styphnate, and 1 : 3 : 5-trinitrobenzene complex has been prepared. The physical properties of these hydrocarbons and their ultra-violet spectra have been determined. There is an extensive list of references. A. R. W. B.

172. Selective Hydrogenation of Diolefins to Olefins. G. Natta, R. Rigamonti, and P. Tono. *Chim. e Industria*, 1947, **29** (10), 235–237.—In many processes for the utilization of olefins from cracking processes, it is useful to eliminate the diolefins present,

which tend to give rise to secondary yield reducing reactions, poison the catalysts, and alter the characteristics of the final product. Among the possible methods for achieving this elimination one of the most simple and attractive (although it does not result in any recovery of diolefins) is selective hydrogenation of diolefins to olefins. Up to the present, such hydrogenation has only been accomplished in good yield by the use of costly catalysts on a palladium base. Less rare metals have now been examined, and using a catalyst prepared by the reduction of co-precipitated Ni and Zn chromates, quantitative selective hydrogenation in the gaseous phase at ordinary pressure has been obtained of butadiene to butylene and of 1 : 3-pentadiene to pentene. The hydrogenation is not selective in the liquid phase under pressure. D. H. McL.

173. Low Temperature Polymerization of *iso*Butene by Titanium Chloride. P. H. Plesch. *Nature*, 1947, **160** (4077), 868.—Water, sulphuric acid, and 20% oleum acted in the low temperature polymerization of *iso*butene, with hexane as solvent, as co-catalysts in the presence of titanium chloride, but had no effect in its absence. Dry trichloroacetic acid was soluble in hexane, formed a complex with titanium chloride, and acted as a co-catalyst with the latter; and the polymer thus produced was free from opacity until exposed to the atmosphere.

Monochloroacetic, dichloroacetic, and picric acids were inactive as co-catalysts at − 75° C, but whereas the first two slowed down the polymerization afterwards induced by trichloroacetic acid, picric acid had no such effect. H. C. E.

174. Action of Per-Acids on *iso*-Octenes. J. G. M. Bremner. *Nature*, 1947, **160** (4069), 575.—The action of per-acids on *iso*-octenes (see Abstract Nos. 1188, 1886, (1947)) can be explained by the formation of a type of carbonium ion, which subsequently undergoes (1) proton loss to give unsaturated alcohols; (2) anion addition to give glycols; and (3) condensation with epoxides to give dioxans. The work described throws no light on the double bond shift which occurs during the air oxidation of olefines.

[Reply by W. J. Hickinbottom.]

Whilst further experimental work is required to establish the truth of Bremner's suggestion, it is considered that the carbonium ion would lose a proton from the oxygen rather than the methyl group during (1) above. Further, the free radical hypothesis cannot account for the formation of epoxides and dimers which are produced during autoxidation. H. C. E.

175. Institute of Petroleum Hydrocarbon Research Group. Anon. *J. Inst. Petrol.*, 1947, **33**, 580.—A review of the progress of the research from 1945–47. A list of publications by this group is given. A. R. W. B.

176. Study of Aluminium Soap-Hydrocarbon Systems: "Calotropy" and True Stability of the Jelly Phase. K. J. Mysels. *J. Coll. Sci.*, 1947, **2**, 375–382.—Viscosities of the system *cyclo*hexane/aluminium dilaurate were measured by timing the rise of a bubble between two points in a sealed tube containing the mixture. Systems containing 1, 2·5, 4·1, and 9·5% aluminium dilaurate have viscosities little more than that of pure *cyclo*hexane at high temperatures, but increase, in some cases many thousandfold, at low temperatures. The temperature at which the viscosities approach that of *cyclo*hexane bears no relation to the melting point of the soap, as in the system calcium oleate/hydrocarbon, showing that the colloidal particles are a reaction product of soap and *cyclo*hexane.

"Calotropy" (or the temporary reduction of viscosity by prior heating) and thixotropy at 4·1% soap concentration were measured, and it is deduced that spontaneous formation of a jelly (single phase) structure occurs at temperatures between 80 and 150° C, and the jelly is thermodynamically stable in this temperature region and between 2 and 10% soap concentration. Outside these ranges the jelly may exist as an unstable or a metastable phase. H. C. E.

177. Improved Method for the Interpretation of Experimental Data Obtained in Molecular Weight Determinations of Petroleum Fractions. J. G. Reynolds. *J. Inst. Petrol.*, 1947, **33**, 491.—A method of interpreting data obtained with the Menzies–Wright ebullioscopic apparatus or by the cryoscopic technique, which eliminates the

effects of errors in the zero reading of the Menzies differential thermometer or in the value found for the freezing point of the pure solvent. Apparent changes in boiling point or freezing point are plotted against concentration of solute resulting in linear relationships in all cases so far examined. The molecular weight of the solute is calculated from the gradient of the line so obtained. A. R. W. B.

178. Ionization Phenomena Accompanying Hot-Point Ignition of Hydrocarbon Mixtures. R. Vichnievsky. *C.R. Acad. Sci.* (*Paris*), 1947, **225**, 992–994.—In previous work (see Abstract No. 120 (1948)) on pre-ignition in an automotive engine by a heated filament acting as an artificial hot-spot, the ionization current to an exploring electrode in the combustion chamber was used to detect pre-ignition. The nature of the ionization current has now been studied in greater detail. It is greater by a factor of 8–10 with the electrode positive with respect to the fuel–air charge than with the electrode negative. With the electrode positive the record of ionization current versus time shows irregularities which are not obtained with the electrode polarity reversed. These irregularities are related to periodic variations in ionization current which occur when self-ignition of the charge is accompanied by knock.

When the filament is not heated, the propagation time of the flame to the exploring electrode can be measured by registering the ignition spark on the ionization current record. With the filament heated (but below the pre-ignition temperature), inflammation of adjacent unburnt charge occurs in advance of the arrival of the primary flame front resulting in an apparent reduction in the flame propagation time. Coincidence of the ignition spark with the start of the ionization current indicates the hot filament temperature that is required for pre-ignition of the charge under the temperature–pressure conditions defined by the ignition spark timing. In certain cases the hot filament temperature required for inflammation of residual charge may refer to fuel already pre-oxidized to some extent.

Indirectly the hot point thus results in an apparent reduction of the flame propagation time. This effect applies as soon as it causes inflammation of the residual unburnt charge, which is then detected by the exploring electrode before the arrival of the primary flame front. Changes in the relative positions of the hot filament, sparking-plug, and exploring electrode do not alter this effect. G. H. B.

179. New Technique for Following the Attack of Metallic Mirrors by Free Radicals. G. Whittingham. *Nature*, 1947, **160** (4072), 671.—In detecting and estimating free radicals the removal of metallic mirrors is usually followed by photometric means, but in studying free radicals produced from coal and its products at high temperatures the evolution of smoke and tars render this method unreliable. It was found that the current passing between two thermocouples set in a convex surface could be used as a measure of the removal of the mirrors. When nitrogen containing tetra-ethyl lead was passed across the heated convex surface, lead began to deposit at 180° C and built up rapidly at 200–220° C. By applying heat at increasing distances from the resulting mirror after it had cooled, the time of its disappearance could be followed electrically. In this way the half life of the ethyl radical was found to be 0·014 sec. H. C. E.

180. Viscosity Under Rapidly Varying Pressure. F. Charron. *C.R. Acad. Sci.* (*Paris*), 1947, **225**, 919–921.—The increase in viscosity of liquids under pressure is of practical importance in the case of lubricants subjected to severe loading. In the case of a shock load of short duration it is of interest to determine if the lubricant viscosity increases instantly to the value for the same load permanently applied. The method of ballistic viscosimetry has been applied to the study of this problem, the fundamental equation of the method being modified to deal with conditions in which the viscosity is not constant. An exponential expression is used to represent the variation of viscosity with pressure and some results given for glycerol and an aviation lubricating oil. For a pressure increase from 1 to 1000 atmospheres the viscosities of these two liquids at 14·5° C increase by factors of about 2 and 20 respectively. This exponential expression is used to derive an equation for the ratio of the liquid deliveries in the ballistic viscometer for the two conditions in which the liquid viscosity is treated either as constant or dependent on pressure. For glycerol, the change of viscosity with pressure is small and the observed ratio of the deliveries under these two conditions is in good agreement with the ratio calculated from the formula. For the aviation lubricating oil, with a

large viscosity–pressure coefficient, the experimental value of the ratio exceeds the calculated value by a factor of 3. It is concluded that a hysteresis effect retards the increase of viscosity with rapid increase of pressure to the corresponding static value used in the calculation. It is pointed out that the effects studied are complicated by temperature changes in the liquid due to compression and wall effects in the viscometer capillary, but that the results obtained with glycerol justify the theoretical treatment. Further work will be required to confirm the hitherto unknown property of pressure–viscosity hysteresis in viscous liquids. G. H. B.

181. Reference Fuels for Knock-Rating in Spark Ignition Engines. Anon. *J. Inst. Petrol.*, 1947, **33**, 578.—The original O.N. scale has been extended in the upper direction by several methods two of which are currently in general use: (1) the use of *iso*-octane with incremental additions of lead tetraethyl; (2) the use of blends of *n*-heptane and *iso*-octane with a constant addition of lead tetraethyl.

It is also indicated that the Institute of Petroleum Standardization Committee will in future specify the use of blends of *n*-heptane and *iso*-octane for all testing procedures as a result of their increased availability. A. R. W. B.

182. Combustion Studies by Means of the Electrical Conductivity of Flames. R. Vichnievsky. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 293–304.—A review is given of the electrical methods that have been suggested for determining ignition delay in C.I. engines. A circuit is shown whereby the mean current flowing in the plate circuit of a thyratron is, for a given engine speed, proportional to the average ignition delay. Some of the conductivity methods that have been put forward for measuring flame velocity, are also described. Tests carried out on a C.F.R. engine, using a single-test electrode positioned directly opposite the sparking-plug and plotting the ionization current against the C.R. showed a marked divergence of the curves for 60 and 100 O.N. fuels when a C.R. of 7 : 1 was reached. Changes in ionization current are especially sensitive to weak knock and the results obtained from an electronic indicator (circuit given) show a more linear relationship to C.R. than do knockmeter readings. V. B.

183. New Method for the Presentation of Test Results on the Four Ball Machine. W. Davey. *J. Inst. Petrol.*, 1947, **33**, 574.—The present method of presentation of results of tests on the four ball machine is discussed and a new method is proposed. It is suggested that the wear–load relation be expressed as a wear–load ratio, that the maximum load tested or determined be stated, and that the friction–time curves be referred to standard curves, observations on the type, occurrence and duration of seizure and of the maximum friction being given. A. R. W. B.

184. Preliminary Notes Concerning the Use of the Electron Microscope for the Examination of Lubricating Oils. P. de Fouchécour and T. Reis. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 288–292.—A description of preliminary examinations of oil films with an electron microscope (resolving power 4 mμ, direct electrostatic magnification 10,000 dia). Sample films (on thin layers of collodion, gold or silica) were prepared by five methods, one of which is applicable only to metallic particles, which are separated magnetically. Eight photographs are reproduced showing the results obtained on three used oils (films of which were prepared by various methods) and one new oil. It is concluded that the electron microscope will be a valuable auxiliary in oil analysis, especially for the detection of metallic particles in used oils, as soon as the necessary background of experience has been established by a number of tests, and sampling methods have been rigidly specified. V. B.

185. Influence of Water on the Lubrication of Metals. E. D. Tingle. *Nature*, 1947, **160** (4073), 710.—Experiments show that both water and oxygen are necessary for the lubrication of metal surfaces by fatty acids. By cutting a fresh surface of copper, cadmium, or magnesium under the lubricant, it is shown that 1% lauric acid in paraffin is no more effective as a lubricant than paraffin alone, and even after exposure of the surfaces to air for 24 hr, lubrication is still ineffective. However, if the surfaces are covered with a film of water and allowed to dry before applying the lubricant, good lubrication is obtained.

Two explanations of this phenomenon are given, both involving chemical reaction between water, the metal surface, and the fatty acid. H. C. E.

Analysis and Testing.

186. Evaluation of Water-Resistance Properties of Lubricating Greases. T. G. Roehner and E. S. Carmichael. *Oil Gas J.*, 25.10.47, **46** (25), 107.—Methods employed for evaluation of resistance to washout provide for working water into the grease. The water-absorption test is described in U.S. Specification AN-G-3a and AN-G-10, and the water-resistance test in AN-G-5a, AN-G-15, and AN-G-25. Data obtained from laboratory and field evaluations show that the water-resistance properties of grease under service conditions depends on metallic and fatty components of soap, mineral oil, reaction of finished grease, additives, bearing design, and operating conditions; the effects of certain of these are tabulated.

The ability of greases to protect the bearings from rusting when exposed to contact with water, including condensation from humid atmosphere, is interrelated with resistance of greases to washout from bearings, but recommendations should not be based entirely on this ability.

Two tables are provided showing humidity cabinet and corrosion tests on various greases. G. A. C.

187. Ultra-Violet Light Absorption by Organic Substances. L. W. Marrison. *Industr. Chem.*, 1947, **23**, 817–826.—A survey of the way in which U.-V. spectroscopic measurements reveal unsaturated structures in organic molecules—the principal chromophores (*i.e.*, C = C, C = O, N = N, NO_2, C ≡ N, N = O, $O.NO_2$, C ≡ C, and C = S); the effects of multiplication of chromophores in the molecule (*e.g.*, conjugation); the effect of the relative position of the chromophore and influence of the rest of the molecule are discussed. Examples are drawn from classes of molecules containing each of the chromophores and include polynuclear hydrocarbons, heterocyclic compounds, and molecules with mixed chromophores such as unsaturated carbonyl compounds, unsaturated and dicarboxylic acids. The effect of aromatic substitution on the intensity, position, and splitting of the bands is also discussed. References and bibliography are given. E. B.

Crude Oil.

188. Refining South American Crudes. D. Read and G. Egloff. *J. Inst. Petrol.*, 1947, **33**, 621.—Information on the properties of various South American crudes is summarized and the application of several refining processes to these crudes is illustrated. A. R. W. B.

Engine Fuels.

189. Effect of Sulphur and Phosphorus on Aviation Fuel Performance. T. K. Hanson and K. F. Coles. *J. Inst. Petrol.*, 1947, **33**, 589.—The effect of small quantities of sulphur and phosphorus and their compounds on the performance of fuels is discussed both for octane (motor method) ratings and rich mixture performance (3-C) ratings.

It is shown that the adverse effect of sulphur on engine performance of leaded fuels is very much greater by the rich mixture rating than by motor method rating, but that phosphorus shows the reverse effect, having for very low concentrations a slight positive effect on rich mixture rating. The effect on fuel performance of different classes of compounds containing these elements is discussed. A. R. W. B.

Gas Oil and Fuel Oil.

190. Liquid Fuels and Chemical Products from Petroleum and Coal. F. H. Garner. *J. Inst. Petrol.*, 1947, **33**, 678.—The use of liquid fuels for power and heat generators is discussed and the importance of coal and crude petroleum as sources of such fuels is debated. A summary is also made of the further synthetic chemicals which can be obtained from these two sources. A. R. W. B.

191. Recent Developments in Fuel Technology. Anon. *Chem. Engng*, April 1947, **54** (4), 127–132.—The heavy drain on American oil reserves during the war coupled

with the falling off of new oilfield discoveries since 1939 has lent new significance to the subject of substitute liquid and gaseous fuels. Natural gas and coal are, of course, the raw materials for the project and the Fischer–Tropsch, Lurgi, and Winkler processes are the ones in which most interest has been taken. O. M.

192. Combustion Calculations for Hydrocarbon Fuels. H. R. Linden and D. F. Othmer. *Chem. Engng*, April 1947, **54** (4), 115–119; May 1947, **54** (5), 148–153.—By means of correlating specific heat and heat of combustion with carbon/hydrogen ratio the calculations connected with various combustion problems, *e.g.*, air requirements, stack losses, flame temperatures, with hydrocarbon fuels, are greatly simplified. Corrections for the variables of air humidity, air temperature, and dissociation of carbon dioxide and water vapour are included in the system. O. M.

Lubricants.

193. Simple and Mixed Esters of Phosphoric and Thiophosphoric Acids. G. Jacini. *Chim. e Industria*, 1947, **29** (10), 244–245.—Some of the lesser known members of the series of trialkyl phosphates and also a number of mixed di-aryl alkyl thiophosphates were prepared. The following method was found to give the best yield in the preparation of tri-*iso*amyl phosphate. 40 g. $MgCl_2$ (catalyst) were vigorously stirred with 198 g. *iso*amyl alcohol at 120–130° for 30 min. The mixture was then cooled to 10°; 47 g $POCl_3$ were then added with stirring over a period of 6 hr so that the temperature did not exceed 20°. Stirring was continued overnight. Then 40 g anhydrous Na_2CO_3 were added, and the temperature maintained at 25–30° for a further 12 hr. After filtering, the reaction mixture was well washed and distilled. Tri-*iso*amyl phosphate was obtained at 150°/0·12 mm in 95% yield. (P% found 9·93; $C_{15}H_{33}PO_4$ requires 10·04%.) The following other phosphates were prepared: tri-*n*-hexyl phosphate (b.p. 160–170°/0·15 mm; P% found 8·52; $C_{18}H_{39}PO_4$ requires 8·87%); tri-*n*-octyl phosphate (b.p. 200–220°/0·08 mm. P% found 7·11; $C_{24}H_{51}PO_4$ requires 7·15%); tri-2-ethylhexyl phosphate (b.p. 190–200°/0·08 mm; P% found 7·00; $C_{24}H_{51}PO_4$ requires 7·15%); tri-*n*-decyl phosphate (m.p. 40°; P% found 5·98%; $C_{30}H_{63}PO_4$ requires 5·33%).

The following method was adopted for the preparation of diphenyl ethyl thiophosphate. Ethyl thiophosphoric acid dichloride ($C_2H_5OPSCl_2$) was prepared in a crude state by adding 1·1 mol anhydrous ethyl alcohol to 1 mol $PSCl_3$ dissolved in a small amount of benzene, stirring and maintaining the temperature about 0°. This was then warmed to 30° for 1 hr.

After cooling, the crude dichloride was reacted with excess of dry sodium phenate (4 mol). Reaction was completed by warming for a short period to 50°. The reaction mixture was washed with water and distilled. Diphenyl ethyl thiophosphate was obtained at 140–160°/0·09 mm in 60–75% yield. (P% found 10·67; $C_{14}H_{15}O_3PS$ requires 10·54%.)

The following other thiophosphates were prepared: diphenyl *iso*propyl thiophosphate (b.p. 150–170°/0·09 mm; P% found 9·89; $C_{15}H_{17}O_3PS$ requires 10·07%); diphenyl-*n*-butyl thiophosphate (b.p. 160–175°/0·09 mm.; P% found 9·35; $C_{16}H_{19}O_3PS$ requires 9·63%); diphenyl *iso*amyl thiophosphate (b.p. 160–180°/0·09 mm; P% found 9·00; $C_{17}H_{21}O_3PS$ requires 9·23%). D. H. McL.

194. Lubricating Oil Filtration. C. G. Vokes. *Gas Oil Pwr*, 1947, **42**, 341.—Filtration must accomplish (*a*) the removal of metal filings, sand, etc, from a new engine; (*b*) the separation of operational deposits—carbon, sludge, dust, etc—which are formed while the engine is in use. This can be achieved by (1) full-flow filtration; (2) by-pass or partial flow filtration; (3) periodic removal of the crankcase oil for external treatment. The first is the most effective method of dealing with the problem.

In the full-flow filter the dirty oil should be directed from the inside to the outside of the filter element, for the pressure release valve (which operates when the oil is cold) will then not fail to close due to inclusion of dirt between the faces; and dirty oil will not get into the engine when the element is removed for cleaning.

With by-pass filters the element is very efficient, but only a small proportion of the oil can pass through and this is doubly disadvantageous in operating under cold atmospheric conditions. Since by-pass filters are claimed to remove very fine particles

it is sometimes necessary to combine both full-flow and by-pass types. The dirty oil passes from the full-flow unit to a section comprising a series of hollow ceramic discs, which can be cleaned while the filter is in use by actuating a set of scrapers which remove the accumulated sludge. H. C. E.

195. Forty Years of Automotive Gear Lubrication. A. E. Hickel. *Refiner*, Sept. 1947, **26** (9), 89–91.—The advances made during the last 40 years in automotive transmission systems have necessitated the production of lubricants with progressively increasing extreme pressure properties and, because of this, the fabrication of more and more stringent test methods to allow the assessment of the new blends.

Steam cylinder oil was an effective lubricant for the early cars utilizing straight bevel gears, but with the evolution, through spiral bevel gears, to the modern hypoid type, lubricants containing extreme pressure additives (such as combinations of sulphur-, chlorine-, and phosphorous-containing materials) have been prepared and alongside this advance, full-scale axle tests such as the Gleason test, shock-loading test at high speeds, and the 30-hr high torque, low-speed test have been developed. O. M.

196. Vegetable Oils as Fuels [for C.I. Engines]. A. W. Baker and R. L. Sweiger. *Gas Oil Pwr*, 1947, **42**, 338.—Peanut oil, soya-bean oil, cotton seed oil, and diesel fuel were compared in a Fairbanks–Morse single cylinder C.I. engine with a 4½ in by 6 in cylinder giving a compression ratio of 14½ : 1 and an output of 10 b.h.p. at 1200 r.p.m. The pintle-type injection needle delivered a constant amount of fuel into a precombustion chamber. Heating values of the vegetable oils were of the order 17,000 B.Th.U./lb, and their viscosities were somewhat higher than that of diesel fuel.

The vegetable oils showed pressure decreases following the compression stroke, due probably to late burning. The load range was lower than that for diesel fuel, but it was thought that the range could be extended by redesigning the engine. At sustained maximum load engine performance became erratic, with high exhaust temperatures, and to continue the run the load had to be reduced for a time. On stripping the engine at the point when running became erratic, heavy carbon deposits were found at the end of the injection needle.

It is concluded that peanut oil is better than soya-bean or cotton-seed oil, which approximate to each other in performance; and that all the oils are possible fuels for C.I. engines. H. C. E.

197. The Extreme Pressure (E.P.) Lubricating Properties of Some Bromine and Iodine Compounds, Alone and in the Presence of Sulphur, with Observations on the Mechanism of the Development of E.P. Properties. W. Davey. *J. Inst. Petrol.*, 1947, **33**, 673.—Certain bromine and iodine compounds show E.P. properties when blended in mineral oil. The bromine compounds are markedly superior to the corresponding chlorine compounds, whilst the iodine compounds are inferior to both bromine and chlorine compounds in E.P. properties on the results of tests on the four ball machine. The E.P. properties of blends of bromine and iodine compounds are greatly improved by the addition of reactive sulphur.

The mechanism of action of bromine and iodine compounds as E.P. additives has been shown to be similar to that of chlorine compounds. A. R. W. B.

198. Some New Extreme Pressure (E.P.) Lubricating Oil Additives Containing Chlorine and Sulphur. W. Davey. *J. Inst. Petrol.*, 1947, **33**, 527.—The condensation of chloral with mercaptans, in presence of acid gives trichlorothioacetals which show marked E.P. properties when blended in mineral oil. These compounds are active at low concentrations and the good E.P. properties shown are due to the presence of a Cl_3·C-group. The E.P. properties of the compounds have been assessed by the four ball machine. A. R. W. B.

199. Metallic Soaps for Grease. S. B. Elliot. *Oil Gas J.*, 1.11.47, **46** (26), 63.—A review is given of metallic compounds, lubricating oil, and peptizers used in grease manufacture, and metallic soap–hydrocarbon systems and syneresis are discussed. The chain lengths of the fatty acids present vary from 14 carbon atoms to 22, and this is an important factor in determining the gelation characteristics of the soap.

Soaps of some unsaturated acids are necessary to secure adequate hydrocarbon solubility.

Of the metallic soaps used, viz. calcium, sodium, barium, aluminium, lithium, and lead, only lead presents special problems in compounding.

The solvent characteristics of the lubricating oil are of great importance, naphthenic hydrocarbons possessing the higher solvency.

Greases may consist of gels of crystalline particles in oil, others may be true jellies, and a spontaneous phase change must be avoided. Reversal is caused by peptizers agents, and aluminium soaps appear to be highly sensitive to peptization by water. Other peptizers include amines and phenols. Lead soaps find use where mild extreme pressure conditions are met, barium types being unctuous and non-fibrous materials giving high performance under severe conditions.

Calcium soaps can be manufactured by a continuous process, and are simple to prepare by the usual methods of reaction.

Lithium soaps have properties different from those exhibited by other alkali metal soaps, and although sodium soaps are easy to prepare, the chemistry of their hydrocarbon solution is complicated. G. A. C.

200. Oxidation of Transformer Oil. P. M. Heertjes, C. D. Ten Have, and J. J. Lock. *J. Inst. Petrol.*, 1947, **33**, 552.—With the object of obtaining information as to the mechanism of the ageing of transformer oil, measurements of the dielectric losses occurring on oxidation have been made.

The acid, saponification, and hydroxyl numbers, etc., of the oil have also been determined, as well as the amounts of water, carbon dioxide, and volatile products formed during the oxidation. A. R. W. B.

Derived Chemical Products.

201. Solvent Extraction of Indene and Coumarone from Coal Tar Light Oils. A. W. Gauger and J. N. Breston. *J. Inst. Petrol.*, 1947, **33**, 687.—Styrene, indene, and coumarone are found in the solvent naphtha fraction of light oils obtained in the commercial carbonization of coal. The previous literature on attempts to extract these resin-forming substances is reviewed and details of solubility measurements of indene, coumarone, and solvent naphtha in various solvents are given.

It has been shown by work on prepared solutions and an industrial source raw material that practically pure products can be prepared from coal tar light oils by the method of selective solvent extraction. A. R. W. B.

Coal, Shale and Peat.

202. Oils from Coal. A. C. Fieldner. *Gas Oil Pwr*, 1947, **42**, 364.—In the Bergius-I.G. (I) and the Fischer–Tropsch (II) processes, liquid fuel is the primary product, whereas in high- or low-temperature carbonization of coal it is a by-product. In method (I) a paste of powdered coal and heavy oil is heated at 3000–10,000 p.s.i. and 800–900° F in the presence of a catalyst, and the oil products are separated into three fractions, of which the light oil is refined directly to gasoline and the heavy oil is recycled with the coal. All oils have high naphthenicity and aromaticity. In method (II) coal or other carbonaceous material is reacted with steam to produce water gas, which is catalyzed at 15–150 p.s.i. and 300–400° F to form oils and waxes. The product has high paraffinicity and low octane value, but can be reformed to *ca* 70 O.N. It also makes a diesel oil of high cetane number. H. C. E.

203. Gasifying Coal Underground. J. V. Hightower. *Chem. Engng*, 1947, **54** (4), 107–109.—Coal gasification experiments began in January 1947 in the bituminous mine at Gorgas, Ala., U.S.A. A horizontal U-shaped duct was cut in a 36-in coal-seam lying at a depth of 30 ft. Combustible gases are produced by blowing in steam and air. Temperatures, pressures, and gas compositions are determined at various points where 4-in pipes have been sunk vertically. The input of air is limited to 1400 cu ft/min at 1·5 p.s.i. because of the light overburden; the latter allows subsequent stripping for examination of the coal. Eight adits along the two entries (140

and 170 ft respectively) were provided with Pyrex glass vision slots, but following burn-outs these were sealed. Combustion was started by incendiary bombs dropped through 4-in pipes on to broken coal in the 40 ft cross cut. Steam, air, or oxygen is blown in during a run. Average temperature range is 1300–1500° F; calorific values of gases are correspondingly low, but higher temperature is difficult to obtain because of low air input. E. B.

Miscellaneous Products.

204. Aluminium Stearate Gels in Light Hydrocarbon Oils. C. M. Cawley, J. H. G. Carlile, J. G. King, and F. E. T. Kingman. *J. Inst. Petrol.*, 1947, **33**, 650.—An account is given of the preparation and properties of gels of aluminium stearate in various solvents, including benzene, *cyclo*hexane, *cyclo*hexene, and petrol. The effects of so-called peptizers, phenols, alcohols, etc., on the gelation process and gel properties are described. The effect of variables, such as concentration of soap and peptizers, moisture content of soap, and conditions of preparation on the stability of the products was examined. Other properties of the gels considered included the phenomenon of anomalous viscosity and temperature sensitivity. A. R. W. B.

205. Fundamental Properties of Carbon-Black. L. H. Cohan. *India Rubber J.*, 1947, **113**, 659–663.—The fundamental properties important in determining the behaviour of carbon-black in elastomers are discussed. The particle size distribution curve is reasonably symmetrical; from electron microscopic and low-temperature nitrogen adsorption investigations the particles appear to be spherical, non-porous units having a fairly smooth surface. Variations in particle size cause changes in rubber properties, as do variations in size and shape of the secondary aggregates; the mode of occurrence of aggregates is discussed. The surface chemistry of furnace and channel black is discussed, the latter having appreciable amounts of oxygen on the surface, in the form of oxides, which influence the modulus and rate of vulcanization. The crystal structure is outlined, in relation to that of graphite, and also its influence on rubber properties. The chemical composition of carbon-blacks is briefly considered; blacks prepared from sweet gas have a sulphur content near zero, whereas those from gas containing H_2S may contain 0·5% sulphur. C. N. T.

206. Chemicals from Petroleum. E. R. Smoley, R. M. Torrey, and T. L. Kniel. *Refiner*, Nov. 1947, **26** (11), 136–140.—See Abstract No. 126 (1948).

207. The Synthetic Aliphatic Industry. I. H. B. McClure and R. L. Bateman. *Chem. Eng. News*, 1947, **25**, 3208–3214.—The growth of the U.S. aliphatic industry over the past 20 years is illustrated and discussed on a tonnage and dollar value basis and compared with overall production of inorganic and organic chemicals. The synthetic aliphatics are further considered classified as hydroxyl, halogenated and nitrogen compounds, ketones and aldehydes, acids and anhydrides, ethers, and miscellaneous compounds. The development and applications of individual compounds is reviewed. Among the more interesting developments are triethylene glycol, an effective antibiotic for air sterilization; alkyd resins developed from penta-erithytol; 2-methyl-2, 4-pentanediol for steam set inks; the mosquito repellant 2-ethyl-1, 3-hexanediol; higher polyethylene glycols, the water soluble carbo-waxes remarkable for their impact resistance; polyalkylene having the characteristic properties of high viscosity index, low pour-point, and oxidation stability, and used, for example, in brake fluids, textile lubrication, and rubber mould lubrication. In the plasticizer field high quality artificial leather can be prepared in a single pass through a coater by dispersing synthetic resin particles in plasticizer without the use of volatile solvents. Of the chlorinated compounds noteworthy are the development of synthetic detergents, hard water, and acid stable, from chlorinated kerosine fractions the Santomorses and Nacconols; dichlorpropylene as a soil fumigant. In the aliphatic nitrogen compound field are ion exchange resins; acrylonitrile, an intermediate for the characteristically transparent acrylate resins; ethylenediamine tartrate, wafer crystals of which are used a filter in multiple telephone transmission. Hydrocarbons of importance include polyethylene, with properties akin to wax, of good electrical properties with respect to high frequency application as in radar; *iso*butylene for synthetic rubber and high performance alkylate gasoline. E. S. E.

208. The Synthetic Aliphatic Industry. II. H. B. McClure. *Chem. Eng. News*, 1947, **25**, 3286–3289.—The sources of aliphatic chemicals manufactured have changed radically. In 1925 the tonnage of aliphatics produced was derived from: fermentation 85%, wood distillation 13%, coal 1·9%, natural gas and petroleum 0·1%; and in 1945 from: fermentation 28%, wood distillation 1%, coal 21%, natural gas and petroleum 50%.

Aliphatics from natural gas and petroleum are produced by three main types of reaction: dehydrogenation, chlorination, and oxidation.

These synthetic methods developed and applied by industrial concerns include the following processes: Dehydrogenation by cracking to olefins, sulphation and hydrolysis of olefins to alcohols, from which aldehydes and ketones are obtained on dehydrogenation. In addition to direct chlorination of saturated aliphatic hydrocarbons, chlorination and hypochlorination of olefins yields, alkylchlorides and chlorhydrins and from the latter alkyl oxides, glycols and their ethers, esters and ethanolamines are derived. Synthesis of glycerol developed on the hot chlorination of propylene. A process for the direct oxidation of hydrocarbons to mixtures of acetaldehyde, acetone, methyl alcohol, and propyl alcohol. Water gas from natural gas by oxidation with steam and CO_2 for the Fischer–Tropsch process.

Aliphatics from coal are produced by the stages, coal–calcium carbide–acetylene–acetaldehyde. Monochlorbutadiene, the monomer from which neoprene is made, is produced by dimerization of acetylene to vinylacetylene and hydrochlorination.

In the German aliphatic industry in wartime, aliphatics were derived principally from acetylene because of the oil and gas shortage. Important technical developments were Fischer–Tropsch synthesis and synthetic detergent manufacture by the OXO process where carbon monoxide and hydrogen were reacted with olefins to yield aldehydes. Sulphation of the derived alcohols yielded synthetic detergents.

Attention is being paid to the economics of syntheses developed by J. W. Reppe involving addition of acetylene directly to compounds with the retention of the triple bond or to compounds containing an active hydrogen to yield a vinyl compound, carbonylation reactions and production of vinylethers from acetylene and alcohols.

The consumption of aliphatics by group industries is indicated and discussed.

Future developments are likely to entail a higher proportion of custom built synthetics and development in the biological application field. E. S. E.

209. Synthetic Detergents. C. T. Snell. *J. Chem. Education*, 1947, **24**, 505–511.—The exigencies of war emphasized the necessity for synthetic detergents, and surface active materials which had all the advantages of normal soap without any of its disadvantages, *e.g.*, the latter's poor washing properties in hard water, etc. In the development of such synthetics the three main factors which had to be taken into consideration were nature of soil, nature of cleaning, and nature of surface-active agent, though, reasonably enough, the last was governed to some extent by the first two factors.

The fundamental requirement for cleaning is that the dirt and oil must be separated, and, when this has been accomplished, the soil must be prevented from coagulating and from being redeposited on to the cleaned surface, *i.e.*, the detergent must be capable of holding the soil in suspension throughout the cleaning process.

In order to cope with these requirements, synthetic detergents must not only have good wetting properties, but also good detergent properties, and, since there is no strict line of demarcation, a satisfactory synthetic cleaning agent must have both of these properties, or failing this, must be "tailored" to meet special requirements. The surface activity of any particular compound is governed by the orientation and concentration of that compound at a phase interface which in turn rely upon the relative balance between polar and non-polar groups in its structure. This balance also controls micelle formation in the detergent solution, an important factor in washing processes. In the general run of these materials, which are organic salts, the non-polar group is a non-aromatic carbon chain or else a combination of aliphatic and aromatic groups while the polar group can be any one of a considerable number of water-soluble radicles, *e.g.*, sulphate, sulphonate, and carboxyl, in the anionic class, and amino, etc, in the cationic class. (The former class contains the synthetic detergents which can be produced from petroleum products.) The solubility of synthetic detergents is governed by the nature and chain length of the non-polar groups, *i.e.*, increase in chain length causes decrease in water solubility, and it has been found that relatively high

mol. wt. straight chain non-polar portion confers good detergent properties while relatively low mol. wt. branched chain non-polar portion is what is required for good wetting. These two properties are also influenced by the position of attachment of the polar group to the non-polar group, for instance, positioning near the centre of the non-polar group produces good wetting properties while its end-positioning confers detergency.

The last sections of the article deal with the laboratory methods of evaluation of detergents, *e.g.*, surface tension is a measure of wetting power. O. M.

210. Larvicidal Treatment of Large Areas by Ground Dispersal of D.D.T. Aerosols. F. Brescia and I. B. Wilson. *J. Econ. Ent.*, June 1947, **40** (3), 309–313.—D.D.T. aerosol generators have been tried out in the Solomon Islands against mosquito larvæ. An area of about 1500 acres was treated, and the results showed a reduction of 99% *culicine* larvæ and 94–100% *Anopheles farauti* larvæ. The treatment lasted for 5 weeks, during which time the generator proved entirely satisfactory.

On comparing hand- and power-spray treatments, the aerosol method is shown to be six times more efficient with respect to manpower. An output of 1 quart oil–10% D.D.T. per acre is recommended. The oil used is a mixture of S.A.E. No. 50 and diesel oil.

One literature reference is given, also tables of operational data. W. M. H.

211. D.D.T. Residual Spray Control of Sandflies in Panama. H. Trapido. *J. Econ. Entom.*, Aug. 1947, **40** (4), 472–475.—Results show that good protection against bites of sandflies can be obtained by treating the wire-mesh screens, used for the exclusion of mosquitoes from screened quarters, with a solution of 5% D.D.T. in kerosene. No effective local out-of-doors protection was afforded by spraying possible resting places within a radius of 30 ft. W. M. H.

212. Use of D.D.T. on Citrus Trees in Florida. S. T. Griffiths and W. L. Thompson. *J. Econ. Ent.*, June 1947, **40** (3), 386–388.—D.D.T.–fuel oil emulsion was used in Florida for control of thrips and citricola scale in 1944, 1945, and 1946. No harmful results followed the 1944 application, but after five out of six treatments in 1945 and 1946 there was a serious increase in the occurrence of Florida red scale, citrus rust mites, citrus mealy bugs, and citrus red mites, on the sprayed trees. Control experiments using a straight oil or one with only 0·1 lb D.D.T. per 100 gal of solution showed no unusual increase in scale population. D.D.T. is not therefore recommended for use on citrus foliage in Florida, though it might conceivably be used for ant control if applied as a dust to the trunks and limbs of older trees. W. M. H.

213. Effectiveness of Acaricides in D.D.T. Sprayed Apple Orchards. C. R. Cutright and R. Sutton. *J. Econ. Ent.*, Aug. 1947, **40** (4), 557–561.—A serious problem following the use of D.D.T. in apple orchards is that of a great increase in the prevalence of red mite, due to the high mortality of mite predators caused by the D.D.T.

Factors in control are: (1) applications of dormant spray oil are absolutely necessary; (2) summer spray oils are very effective, but may injure foliage and fruit, and cannot be used with sulphur fungicides; (3) no available acaricides are entirely satisfactory. The most promising ones for summer use appear to be dinitro compounds, preceded by dormant oil applications. Almost every substance tested was found to be more effective when used in combination with oil. W. M. H.

214. The Formation of Insecticidal Films on Building Materials. II. Tests of the Efficiency of Various Types of Pretreatment. P. S. Hewlett and E. A. Parkin. *Annals appl. Biology*, May 1947, **34** (2), 224–232.—Results are given for the effect of thirty different pretreatments on the length of life of toxic films deposited on brick. The film used was pyrethrins in Shell oil P31. The most promising substances included size, starch paste, polyvinyl acetal emulsions, brickwork sealing paint, gelatin and sodium alginate, which were tried out on limewashed brick, wood, cement, and cement–sand mixture. Best results were given by solutions of size and gelatin.

The test insect was the flour beetle, *Tribolium castaneum*. W. M. H.

215. Petroleum Products in the Printing Ink and Allied Industries. A. C. Healey and L. Ivanovszky. *J. Inst. Petrol.*, 1947, **33**, 531.—The most important methods by which a fluid ink is converted into a rub-proof film in the dried print are : (1) oxidation or polymerization using drying oils such as linseed oil ; (2) absorption of the ink into the paper ; (3) evaporation of volatile solvent ; (4) gelation.

Petroleum products are used in the printing industries in three ways—as components of printing inks, as cleaning agents, and as lubricants for printing machinery. These groups are examined in detail remembering that there are no such things as standard formulæ in this industry—each manufacturer formulates his products according to his own experiences. A. R. W. B.

Engines and Automotive Equipment.

216. Power Plant Engineering. F. Nixon. *Flight*, 18.12.47, **52**, 695.—The author outlines the development which has led to the evolution of the self-contained power plant comprising the engine, its mounting, the cooling and oil systems, engine controls, engine-driven accessories, and the cowling. I. G. B.

217. Simulated Altitude Testing. Anon. *Aircr. Prod.*, Dec. 1947, **9** (110), 441.—Details are given of the new De Havilland test chambers for air-frame components and fuel systems. The chamber can be cooled from normal atmosphere temperature down to − 60° C in 80 min. A useful heat load of 80,000 B.Th.U./hr can be absorbed during test. For the simulation of tropical conditions, fans circulate the chamber air through a steam heater in place of the coolers, so enabling temperatures of up to 40° C to be reached. I. G. B.

218. Trends in Aircraft Power Plants. M. U. Clauser. *Aero. Engng Review*, Nov. 1947, **6** (11), 12.—Subjects include progress of maximum b.h.p. output, effect of compressibility, progress of supercharging, equivalent sea level b.h.p. of turbo jet engines, of h.p./lb engine weight and specific fuel consumption. I. G. B.

219. Gas Turbine and Industry. C. Gibbs and A. T. Bowden. *Gas Oil Pwr*, 1947, **42** 365–368.—Since in a gas turbine the torque decreases with decrease in speed, because the mass flow delivered by the compressor decreases as speed is reduced, the compressor may be driven by a separate turbine running in series or parallel with the work turbine. In the open-cycle operation a low pressure work turbine is coupled directly to the alternator working in series with a high-pressure turbine which drives the compressor. The operating characteristics of the work turbine are shown in a series of diagrams, but since the turbine is necessarily of low-pressure design the large volumes involved are probably uneconomic.

To overcome this difficulty the closed and semi-closed cycles of operation have been adopted, in which the mean pressure in the system is raised so that the volume of gases can be limited. In the closed cycle an externally fired boiler must be installed ; in the semi-closed cycle this can be substantially reduced in size, but control in this case becomes more complicated. H. C. E.

220. High-Speed Compression-Ignition Engines. S. Markland and N. Tattersall. *Gas Oil Pwr*, 1947, **42** 321–324.—The design and development of components of high-speed C.I. engines are discussed with particular reference to : fatigue testing of crankshafts, torsional stresses in crankshafts, damper effects in crankshafts, load-carrying capacity of aluminium, copper–lead and iridium-flash bearings, dry liners, connecting-rod design, and tension in big-end bolts.

The optimum performance of an engine can be found by measuring at each speed the maximum torque obtained when the exhaust smoke becomes just visible ; then reproducing as nearly as possible those maxima with the fuel pump delivering a fixed quantity of fuel.

A relationship has been found between the cetane number of the fuel and the starting time of the engine at low temperatures. H. C. E.

221. High Compression Oil Engines. A. Arkinstall. *Gas Oil Pwr*, 1947, **42**, 337.—It is claimed that measurement of exhaust temperatures will provide information about overload, insufficient air, and scaled jackets. Numerical data on engine cooling, oil consumption, and quantity of fuel injected, are given.

The design and construction of piston rings are discussed, and it is stated that the life of a piston ring depends upon piston speed, efficiency of combustion, and efficiency of cooling. H. C. E.

222. Leyland Marine [Oil] Engine for Small Craft. Anon. *Gas Oil Pwr*, 1947, **42** (505), 315.—This engine has six cylinders each of dimensions $4\frac{3}{4}$ in by 5 in and a compression ratio of 15·3 : 1. The pistons are of cast aluminium alloy with a scraper ring and three compression rings of 5° taper. A C.A.V. pump delivers fuel through Leyland multi-hole injectors. For continuous operation the rating is 85 b.h.p. at 1650 r.p.m.

The speed of the engine is controlled by two governors; one controls the maximum speed mechanically and the other is vacuum operated in such a way that the engine speed is constant irrespective of load. All parts except the gearbox are lubricated by a gear pump in a 6 gal sump working at 65–70 lb pressure. H. C. E.

223. Supercharged Dual Fuel Application. Anon. *Diesel Pwr* (*Diesel Transportation*), Sept. 1947, **25** (9), 35.—The conversion of a gas engine to diesel operation without the necessity of using cumbersome expedients has been solved by the dual-fuel engine, which can operate on gas or oil, or on a mixture of both. The basis of such a design is the use of the diesel cycle, combining gas with the normal air intake of the engine, and incorporating a small pilot injection of diesel fuel for ignition of the gas.

A new Worthington type SEHGO-8 supercharged engine of the above design has been installed in the municipal power plant at Lamar, Colorado. For conversion of the SEH supercharged engine of this supercharged dual-fuel type, three major changes were required: (1) a special valve cage with gas inlet valve and passage to replace the standard air inlet valve cage in the cylinder head; (2) an additional Bosch fuel injection system to supply the small amount of essential pilot-ignition oil for gas-diesel operation; (3) a suitable governor control linkage to enable the operator to set the quantity of gas that the engine will consume.

Operating records with this type of engine showed that at full load there was a reduction in fuel consumption from 10,360 B.Th.U./kw-hr on full-diesel operation to 9700 B.Th.U./kw-hr on dual-fuel operation. This saving in fuel costs for added power would make the dual-fuel unit suitable for a wide range of operation, such as oilfields, industrial plant use, etc. C. D. B.

224. German Marine Diesel Engines. H. A. Schade. *Gas Oil Pwr*, 1947, **42**, 353–355.—See Abstract No. 311 (1947).

225. Coventry Godiva Diesel Engines. Anon. *Gas Oil Pwr*, 1947, **42** (505), 291–295.—The Coventry CD4 engine has the following specification: four 82-mm by 105-mm cylinders, maximum output 30 b.h.p. at 2000 r.p.m., b.m.p. $86\frac{1}{2}$ p.s.i., specific fuel consumption 0·40 lb/b.h.p.hr, compression ratio $17\frac{1}{2}$: 1, specific weight $29\frac{1}{2}$ lb/b.h.p. Mechanical construction is described in detail. Built for use under marine conditions, a heat exchanger is attached to each side of the sump, and sea water is circulated to cool the closed-circuit fresh water which is pumped through cylinder block and heads.

Combustion chambers are of the rotational-swirl type, and the fuel injection begins 24° before t.d.c., control being effected by altering the injection period. Pressure lubrication is given to all bearings except the small ends by a gear type pump in a sump of $2\frac{1}{2}$ gal capacity.

Diagrams of engine and graphs of engine performance are given. H. C. E.

226. Repairing Crankshafts. Anon. *Diesel Pwr* (*Diesel Transportation*), Sept. 1947, **25** (9), 56.—A new method of crankshaft journal repair called the "Bingham Sleeving Process" has been devised by the Paxton Diesel Engineering Co., replacing the old metal spraying process. The new method consists of the welding of a specially

prepared steel sleeve to the worn journal, there being no welded bond between the journal and the sleeve.

After preparation of the crankshaft by machining off the damaged surface, a small keyway is cut in the centre of the journal. A special steel sleeve, having an inside diameter ground to the exact size of the journal on which it is to be applied, is then prepared by cutting into half and bevelling the edges, one edge being keyed to fit the shaft keyway. A special welding process is then applied in such a way that the weld does not penetrate to the shaft, or cause heating which might form incipient heat cracks; the normal shrinkage as the weld cools then causes the sleeve to grip the shaft tightly. Finally, the outside diameter of the sleeve is ground to the required specification.

This new method has been successfully used for many railroad diesels, and some shafts are known to have operated for more than a million miles after repair.

C. D. B.

227. Cracking of Diesel Cylinder Head. Anon. *Oil Engine & Gas Turbine*, Nov. 1947, **15** (175), 237.—Overheating is the principal cause of the cracking of cylinder heads. The engine cooling system should therefore be as efficient as possible, with a free and rapid flow of water. Impurities and scale-forming material in the water should be removed. Local overheating should be avoided by maintaining fuel injectors in good condition, and fuel valves should be able to work freely.

Another common cause of overheating is undue clearance between the tappets and exhaust valve spindles; if this occurs, the valve lift is restricted and the exhaust gases cannot escape freely. Attention should also be paid to the exhaust gas piping, which should be designed so that expansion of the pipe due to the passage of hot gases does not induce stresses which lead to cracking of the head. In addition, the passage of the exhaust gases through the pipe should not be restricted in any way.

Regular inspection of the head should be made for the presence of any fine cracks which may develop into more serious defects. Such small cracks should be wholly chipped away.

C. D. B.

228. Filtration Facts. Anon. *Oil Engine & Gas Turbine*, Nov. 1947, **15** (175), 216.—A diesel engine test has been conducted by Vokes Ltd., to investigate how lubricant filtration equipment would operate with a detergent oil, the engine used being a Fowler 4-cylinder 4B type rated at 40 b.h.p. The oil in service was Esso H.D.30, and standard air and fuel filters were used as well as a full-flow lubricating oil filter. Sump oil and lubricant filter elements were changed after each 1000 hr running.

The unit was stripped after 5200 hr of operation, and was found to be in very good condition. All the piston rings were free, and carbon deposits were easily cleaned away. Wear was generally slight. It seems from this test, therefore, that a detergent oil can be filtered satisfactorily without rapid blocking of the oil filter, or removal from the oil of its detergent characteristics.

C. D. B.

229. Modern Sulzer Marine Engines. J. Calderwood. *Gas Oil Pwr*, 1947, **42**, 331–334.—Engines with four to twelve cylinders, covering a range of power from 2000 to 8400 b.h.p., are constructed from two cylinder sizes; one of 600-mm bore and 1040-mm stroke giving 500 b.h.p. at 150 r.p.m., and the other of 720-mm bore and 1250-mm stroke giving 700 b.h.p. at 125 r.p.m. The frame construction, cylinder liners, crosshead, and pistons are described in detail. The arrangement of one scavenging pump per cylinder ensures that scavenging conditions in each cylinder is the same, resulting in equal temperature conditions and equalization of loads.

The lubrication system differs from standard practice in that most of the oil is fed to the crosshead, from which one branch leads to the piston head for cooling, and a second branch leads to the top end-pin and thence to the bottom end bearing. Thus a large quantity of oil is always flowing through the crosshead bearing. Separate leads are provided for the lubrication of camshaft, scavenging pump, etc. Oil cooling of the pistons has overcome troubles due to leakage of cooling water into the crank chamber. The cylinder liners and covers are cooled with fresh water in a closed circuit.

H. C. E.

230. Plain Bearings. W. H. Tait. *Gas Oil Pwr*, 1947, **42**, 346–348.—The load-carrying capacity of bearings depends upon the type of lubrication, and upon the

capability of the lubricant to force its way, or be forced, between the bearing surfaces. Thus in lubrication by oil-can the permissible load is only one-ninth that of the same bearing to which lubricant is supplied at 45 p.s.i. pressure. The load-carrying capacity of the bearing also increases with the speed of the spinning journal, but when the speed becomes so great that heat is generated faster than it can be dissipated (by the oil or other means), the load-carrying capacity drops abruptly and seizure must eventually occur.

The best bearing material is high-tin babbitt, but babbitts of low tin content or lead are cheaper and often adequate. Being soft, these babbitts must be backed with steel or bronze. Copper–lead mixtures are harder than babbitts, but are particularly useful because they are tolerant of dirty or inadequate lubricants. Bronzes, being harder still, can withstand heavier loadings; phosphor-bronze is hardest of all, but it must be carefully aligned and freely lubricated. Porous oil-retaining bushes which can hold up to 30% by volume of oil are made from metal powders and graphite by a sintering process. H. C. E.

231. An Indentation Method for Measuring Wear. S. A. McKee. *Bur. Stand. J. Res. Wash.*, Aug. 1947, **39** (2), 155–161.—To replace the normal, possibly misleading, methods for measuring wear on lubricated parts during service, a new method has been developed, involving observation of change in dimensions of the base of a pyramid-shaped indentation. Special apparatus has been evolved for making and observing the indentation.

The method is of particular interest in connexion with cylinder wall wear in radial engines, where permanent distortion may nullify, from the standpoint of measuring wear, the significance of the most careful measurement, but provision is also made for its use in connexion with wear on pistons. In fact, it can be applied to any wearing surface where the material is of such a nature that the marks will retain their shape in service. O. M.

MISCELLANEOUS.

232. Progress in Petroleum Research. R. P. Russell. *J. Inst. Petrol.*, 1947, **33**, 391–408 (*Cadman Memorial Lecture*, June 1947).—The impact of petroleum research on present-day industrial needs is described. Descriptions are given of two important processes, catalytic cracking and hydrocarbon synthesis from natural gas or coal and applications discussed. Of chemical derivatives from petroleum it is stated that *all* the organic materials including rubber and alcohol needed to meet the entire world's needs for a year could be made from 10 day's crude oil production. Use of petroleum products in agriculture, rubber manufacture, etc, is described. A. R. W. B.

233. Fuel Economy Conference of the World Power Conference. H. E. Crossley. *Nature*, 1947, **160** (4074), 740 (*Summary of Meeting at The Hague*, Sept. 1947).—Papers presented at this Conference may be classified thus: (*a*) fuel economy; (*b*) liquid fuels; (*c*) fuels in transport; (*d*) fuels for industrial and agricultural appliances; (*e*) national fuel reserves; (*f*) atomic energy.

In section (*b*) the main subject concerned the home production of liquid fuels from indigenous sources, and the preparation of motor spirit of high O.N. Section (*d*) dealt with the use of low-grade fuels, the recovery of heat from waste liquors and the development of the gas turbine. Section (*e*) comprised contributions from Great Britain, Canada, the U.S.A., and France. Other sections considered coal-mining, economy measures in the production of gaseous fuels, transport of gas and electricity, and space heating. H. C. E.

234. Rheology of Minerals. E. W. J. Mardles. *Nature*, 1947, **160** (4076), 844 (*Conference of British Rheologists Club, Manchester*, Sept. 1947).—Among the six papers presented at this meeting, one was concerned with the formation of salt domes and the flowage of rock salt, and two others discussed viscometry. In the former paper the formation of salt domes was illustrated by reference to geological sections of the Persian oilfields, where anticlines 100–200 miles in width are folded with little fracture or faulting although the limestone folds are 2000 ft thick.

One paper on viscometry dealt with experiments at high rates of shear on the shear breakdown of polymer solutions, caused by the mechanical fission of long-chain molecules. The other, a report on industrial viscometers, surveyed the conditions and methods of rheological measurements, and the principles governing routine measurements on non-Newtonian systems were given. The design of some standard orifice viscometers was criticized. H. C. E.

235. **Mineral Production of Canada.** Anon. *Nature*, 1947, **160** (4076), 846.—Taken from "The Canadian Mineral Industry in 1945," this article summarizes the relative importance of the various metals, industrial minerals, and fuels produced during 1945. H. C. E.

BOOK REVIEW.

Petroleum Production. Volume III. Oil Production by Water. Park J. Jones. New York: Reinhold Publishing Co. 1947. Pp. 271 + vii. $5.00.

This is the third volume of a series of text books on production by the same author. The first volume dealt with the mechanics of production, the second with the optimum rate of production.

This third volume concerns itself with production by water. It is divided into two parts—Foundations and Applications.

Under Foundations, physical factors governing the movement of oil through porous media by hydrostatic pressure are discussed, and in the second part, these factors are applied to particular types of reservoir, it being shown that almost any commercial occurrence of petroleum in stratified sedimentary succession of rock can be classified under these types, namely: (1) radial; (2) linear; (3) elongated reservoirs.

It is the objective of the author as expressed in his preface to use statistical procedure aimed at reducing the many variables of his subject to a comparatively few factors, and he disregards the effects of gas either as a cap or in solution. In spite of this essentially simplified approach, due regard is given to the amount of geological variables and the author displays a wide knowledge of their nature and the parts they play.

Units of volume and the standard conditions in general use in oilfields are adopted, and this should be an attractive feature to the practical technologist not wishing to be involved in converting the units of pure science to his uses.

This third volume will be of particular interest to those interested in the possibilities of secondary recovery by water drive, since it sets out the determining considerations which must be borne in mind if peak efficiencies are to be achieved by such methods. E. C. S.

BOOKS RECEIVED.

A.S.T.M. Standards on Petroleum Products and Lubricants. Pp. 690 + xvi. Philadelphia, Pa.: American Society for Testing Materials, 1947. $4.75. Obtainable also from the Institute of Petroleum; £1 5*s*. post free.

Although this latest edition of the A.S.T.M. volume on American standard methods of test contains 75 pages more than the 1946 edition, it does not now include the details of the engine test methods on fuels. These are to appear in a separate volume soon to be issued.

Apart from the usual standard and tentative methods there are nine methods published for information and comment. These relate to preparation of new turbine lubricating systems; evaporation loss of lubricating greases and oils; butadiene content of polymerization grade butadiene by Koppers–Hinckley method; colour index of petroleum products by photoelectric colorimeter; sulphur in petroleum products by the CO_2-O_2 lamp method; mineral oil content of used lubricating oil; acid and base numbers of petroleum oils by alkali blue colour indicator; and by alphanaphtholbenzein colour indicator; and total olefinic and aromatic hydrocarbons in gasoline.

1947 Supplement to Book of A.S.T.M. Standards. Part I. B. Non-Ferrous Metals. Pp. 319 + x. **Part II. Nonmetallic Materials—Constructional.** Pp. 463 + xvi. Philadelphia, Pa.: American Society for Testing Materials, 1947.

These supplements to the 1946 book of A.S.T.M. standards contain the revised standards and new and revised tentatives issued since publication of the 1946 book. Special slips are provided to facilitate annotation in the appropriate pages of the main book.

German and Japanese Intelligence Reports.

B.I.O.S.

1010. Oilfields Investigation. The War Development of the German Crude Oil Industry, 1939–45. Part I. Exploration (Reichsbohrungen and Private) wells.

1011. ——. Part II. Section 1. Exploration.
1012. ——. Part II. Section 2. Exploration Structures.
1013. ——. Part III. Section 1. Development and Exploitation of Oilfields.
1014. ——. Part III. Section 2. Development and Exploitation of Oilfields.
1015. ——. Part III. Section 3. Oil Production Statistics and Analyses.
1016. ——. Part IV. Section 1. The War Structure of the Industry.
1017. ——. Part IV. Section 2. Private Industry.
1188. Preliminary Survey of German Pump Industry. Part I. Centrifugal, axial flow, self-priming, and reciprocating pumps, etc.
1609. Compression Ignition Applied to the Otto Cycle. The "Ring" Process.
1646. Miscellaneous Information on Fuels, Detergents, and Lubricants.

F.I.A.T.

523/586. Study of the Industrial Processing Instrument Industry in Germany.

B.I.O.S./J.A.P./P.R.

914. Fundamental Hydrocarbon Research.
1155. Naval Research on Lubricants.
1313. Naval Research in Aviation Gasoline.

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Oilfield Exploration and Exploitation.

Geology.

236. How Fossil Fish Remains Have Been Used in Pacific Coast Stratigraphy. L. R. Dale. *Petrol. Engr*, May 1947, **18** (8), 104.—Foraminifera have been widely used in age determination, and in the Pacific Coast Tertiary fish remains, especially scales, are second in abundance to foraminifera. Scales and scale assemblages have been shown to have stratigraphic value, and some can be used as index fossils.

Fishes are good indices of palæoecology, because of specialization according to environment. Special techniques have been developed for recovering the scales. Herring types are abundant in the Tertiary, and some are of service in the Miocene and Pliocene. Salmon have proved valuable in Eocene to Middle Miocene; alfonsinos and bermudos are good markers in the Lower Miocene, Oligocene, and Eocene.

G. D. H.

237. Newer Techniques in Aerial Surveying. S. A. Wengerd. *World Oil*, Oct. 1947, **127** (6), 136; Dec. 1947, **127** (8), 131.—Geological interpretation of aerial photographs is most successful where the surface features are directly indicative of the structure and type of the underlying rocks. Qualitative and at times quantitative interpretation is possible. Modern photogrammetric techniques may save much field work in easily interpreted areas. Obliques as well as verticals are employed. Two-stage photography frequently provides excellent results.

Although vertical photographs are sometimes more difficult to interpret, the experienced photo-geologist can do more valuable reconnaissance geology from them than from a set of Trimetrogon photographs. Map making is simpler from verticals.

For Multiplex contouring at 10-ft contour intervals a flying height of 10,000 ft is recommended with either 6-in or 12-in lenses. The 6-in lens requires processing of only a quarter of the stereoscopic models needed to cover the same area with a 12-in lens, although the latter gives double the scale.

If precise large-scale vertical photography is made available for areas to be covered by geophysical work and controlled planimetric maps or mosaics are prepared and supplied to the field crews, shot-points and instrument points can be spotted directly with a geographic accuracy as great as that obtained in traversing or third-order triangulation with the transit.

Areas of low relief can be mapped readily with plane-table base sheets consisting of photographs enlarged appropriately.

Aerial photography is valuable in pipe-line surveys.

A group of oil companies joined in a photographic survey in the Alberta foothills, the cost being $80,000 for about 15,000 square miles. The maps were considered a good base for reconnaissance.

An extensive series of references are appended. G. D. H.

238. Exploratory Drilling in U.S.A. Anon. *World Oil*, Oct. 1947, **127** (6), 79; Nov. 1947, **127** (7), 98; Dec. 1947, **127** (8), 78.—The results of exploratory drilling in the U.S.A. for August, September, and October 1947 are summarized by States and districts. The discoveries each month are listed with brief details. G. D. H.

239. Important Anadarko Basin Strike. Anon. *Oil Gas J.*, 6.12.47, **46** (31), 137.—In Beckham County, Oklahoma, in 14-10n-21w, granite, wash production has been found on the south flank of the Anadarko basin. 469 brl/day of 60°-gravity condensate has been obtained with 5,376,000 cu. ft. of gas on a ¼-in choke. Perforations were in the interval 9260–9360 ft. G. D. H.

240. Anadarko Basin Geology and Oil Possibilities. R. R. Wheeler. *World Oil*, Nov. 1947, 127 (7), 152.—The Anadarko Basin may have been a northwestern extension of the Ouachita geosyncline. During Cambrian to Pennsylvanian time the southern basin areas subsided steadily while the northern and eastern margins tended to be positive. Thus in the latter areas important unconformities were developed, the most important being at the base of the Lower Mississippian Woodford Shale.

The pre-Mississippian beds were bevelled off round the flanks of the Ozark uplift and the Central Kansas uplift.

By late Hunton time numerous gentle flexures existed in Central Oklahoma and also in the west. The Nemaha Ridge had probably not been uplifted in pre-Mississippian time, and there may have been only gentle local warping in the Arbuckle area.

Pre-Mississippian oil possibilities exist in the north and northeast where there are wedge-outs in a dominantly porous dolomite lithology in the Ordovician and Hunton. Further accumulations may arise by the overlap of these reservoir rocks by Mississippian and later source beds. There is a third possibility wherein organically rich Mississippian and Pennsylvanian beds were faulted against older reservoir rocks. Although there is a tendency for oil migration to the wedge-edges of reservoir beds, there is no reason why essentially unwarped basinward equivalents should not have retained some oil.

Mississippian beds were deposited on tilted, gently warped, and truncated older beds. Porous dolomite and cherty facies were developed round the northern margins, and thickened southwards in the basin. The Central Kansas and Ozark uplifts had important movements in the Mississippian. This led to leaching, truncation, and overlap in the north, giving oil traps. In the south there is probably no significant break between the Mississippian and Pennsylvanian.

The arching of the Arbuckles and related uplifts probably began in late Springer times and culminated in post-Atoka, pre-Deese time when the Anadarko basin was formed. Complex faulting accompanied the arching of the Arbuckles and the Pauls Valley uplifts, and descent into the intervening Elmore Embayment is by step-faulting. Displacement decreases northwest from the axes of uplift. The closure and size of structures diminished basinward. It seems likely that the Wichita–Amarillo and the Arbuckle uplifts belong to a post-Morrow, pre-Deese orogeny. There was further uplift and faulting in late Pennsylvanian. The Pontotoc is a facies rather than a time unit.

The early Permian limestones have porous arkosic dolomite facies on the mountain flanks, and these provide scattered pools as in the Amarillo gas field. The Hugoton gas field occurs where Lower Permian cherty limestones grade westwards into an argillaceous facies.

Movements occurred in pre-Middle Permian times when normal marine conditions gave way to evaporites in an enclosed basin. Lack of organic matter has rendered their later deposits poor oil objectives. G. D. H.

241. Oil Prospecting in Alaska. K. M. Fagin. *Petrol. Engr*, Aug. 1947, 18 (12), 43.—Full-scale oil prospecting in Alaska began in 1944, and Umiat No. 1 was spudded in 1945. Several shows were found in the Upper Cretaceous down to 1816 ft. Drilling was resumed in this well in 1946 and several more oil-bearing sandstones were cored and tested before the well was abandoned at 6005 ft. A core test near the crest of the structure and 6 miles east of Umiat No. 1 found some oil at 248 ft, but this has not been tested properly. A second core test is under way ½ mile to the south and this has found an oil sand at 345 ft.

Cape Simpson No. 1 was started in June 1947. This area, like Umiat, has oil seeps. Seismic work has indicated a structure with small closure. Core tests have been drilled at Sentinel Hill (1180 ft) near Smith Bay, Skull Cliff (779 ft) 40 miles southwest of Point Barrow, and Barrow (1442 ft) near Point Barrow.

The Oumalik anticline is being investigated seismically. A flying gravity meter party has been employed. Geological parties are at work along the Colville river, the Kigalik and Awana rivers, the Utukok river, the Shaviovik and Canning rivers, and in the south of the Naval Reserve.

Aeroplanes are extremely useful in the investigations, and operations have to be planned a year in advance. G. D. H.

242. Discovery Highlights Activity in Canada. C. O. Nickle. *World Oil*, Dec. 1947, 127 (8), 266.—10 miles southwest of South Princess gas has been found in the basal

Cretaceous at 3243–3259 ft. There was clean 24°-gravity oil in the lower part. Beneath the sand is shale, and a chert zone, overlying the Madison. The Devonian is to be tested.

Southeast of St. Paul in east central Alberta shallow gas and heavy crude have been found in the Colony sand at the top of the Lower Cretaceous.

The Leduc area has been extended to 6000 acres, and the reserve is estimated at 50–100 million brl.

Five widely spaced wildcats in the Lloydminster region have been drilled and four have had some encouraging signs in the Lower Cretaceous. Two may rank as oil discoveries.

The Nappan test in Nova Scotia has been abandoned at 11,504 ft. G. D. H.

243. U.S. Oil Firms Must Prove Up or Give Up Venezuela Acreage. Anon. *World Oil*, Nov. 1947, **127** (7), 266.—American oil companies hold about 2,887,933 hectares of exploration concessions in Western Venezuela. A substantial proportion of these mature in the near future. The holdings of the various companies are listed.

Zulia 1, west of Lake Maracaibo, is reported to have had a flow of 200 brl on test. Las Pailas-1, in Falcon, has reached a depth of 6500 ft. G. D. H.

244. Drilling in Denmark. Anon. *World Oil*, Nov. 1947, **127** (7), 245.—A deep test is being drilled near Vinding, Ringkobing Province, Denmark. The Germans found oil at Heide, 35 miles south of the Danish border, and gas has been observed in glacial deposits in northern Jutland, near Fredrikshavn. During the war this gas was developed by shallow wells. A recent test in southern Sweden had oil shows in the Trias at about 6200 ft.

The Vinding test is believed to be over a dome located by geophysics. At a depth of 4500 ft it was in the Cretaceous.

Two wells, Harte 1 and 2, were drilled in 1935 and 1936, and Harte 2 met salt at 3500 ft. Later a well was drilled at Vinding, three at Vejrum, and two at Suldrup. G. D. H.

245. Russia 30 Years Behind in Production of Oil has Vast Probable Reserves. W. W. Burns. *Oil Gas J.*, 20.12.47, **46** (33), 44.—Russia has 12,000 oil wells compared with the U.S.A.'s 424,000 producers. Russia's proven reserves are estimated at 8,000,000,000 brl, those of the U.S.A. at 24,000,000,000 brl. The U.S.A. has 900,000 square miles of favourable sediments, with possible oil contents of 100,000,000,000 brl. On the same basis Russia's 1,500,000 square miles of prospective territory should yield about 150,000,000,000 brl.

Up to the beginning of 1947 Russia (including Sakhalin) had produced 5,722,000,000 brl of oil. G. D. H.

246. Egypt's Sudr Field Being Brought into Production. Anon. *Oil Gas J.*, 20.12.47, **46** (33), 42.—The Sudr discovery well, completed at 3157 ft with an initial output of 367 brl/day of 24·5° crude, has been completed as a pumper. Two further wells have been completed, one in the Miocene and the other in the Eocene. The outputs were 605 and 233 brl/day on a ½-in choke. G. D. H.

247. An Abqaiq Seen in New Buqqa Field. Anon. *Oil Gas J.*, 29.11.47, **46** (30), 45.—Three wells have been completed at Buqqa, 20 miles northwest of Abqaiq, Saudi Arabia, but they have not been tested. Oil occurs in the Arab zone which may be Lower Cretaceous or Upper Jurassic. The probable reserves are 2,000,000,000 brl. G. D. H.

Geophysics and Geochemical Prospecting.

248. Flying Magnetometer Completing 80,000-square mile Survey. R. L. Dudley. *World Oil*, Nov. 1947, **127** (7), 247.—The 80,000-square mile aerial magnetometer survey of the Bahamas area will cost about $1,000,000. 80% of the area is shallow water.

Flying is along lines 2 miles apart, with a positional tolerance of about 150 ft. Shoran is used to control the flying. The planes have a recording radio-altimeter, and the Shoran path also is recorded. Shoran stations are set up on boats.

The survey plane makes two flights per day, each of about 6½ hr duration. A ground magnetometer operates continuously to record diurnal variations.

Photographs show the equipment used. G. D. H.

249. Geochemical Survey Data Forecast Major Field. A. Bronston. *World Oil*, Nov. 1947, **127** (7), 112.—A geochemical survey was made in 1942 in the West Edmond field, Oklahoma, several months prior to the discovery of oil. Subsequent development has conformed closely with the anomaly disclosed by the survey. The survey was not completed until several wells had been drilled.

Three sets of samples were taken at each survey hole. The shallowest samples were not really significant; those below about 50 ft were consistent in the hydrocarbon content and can be successfully used in locating oil accumulations.

The adsorptive index of the soils is important, and provides a measure of the relationship between what has been adsorbed and what could be adsorbed. Generally clays will hold no more than 30% of their adsorptive power, and they vary widely in adsorptive power.

Although hydrocarbon values increase materially over oil reservoirs, the concentrations are irregular, and this may be due to lateral and vertical permeability variations. Where there is a non-sealed fault the passage of hydrocarbons gives large hydrocarbon concentrations at the surface where the fault outcrops.

Gaseous and liquid hydrocarbons are concentrated over oil accumulations, and fall to negligible values over dry areas. Solid hydrocarbons or waxes increase immediately below the surface, but decrease at greater depths. Waxes are concentrated along faults in both shallow and deep samples.

A series of diagrams present data obtained in the West Edmond area.

G. D. H.

250. Spectrochemical Sample Logging of Limestones. L. L. Sloss and S. R. B. Cooke *Petrol. Engr*, Aug. 1947, **18** (12), 145.—See Abstract No. 182 (1947).

251. Refraction Surveying of Salt Domes. A. Wolf. *World Oil*, Nov. 1947, **127** (7), 120.—The reflection method is not capable with certainty of predicting whether salt will be found within drilling depth on a given prospect. Thus companies drilling in the Gulf of Mexico may encounter salt and wish to find the exact position and form of that salt. About 17 years ago McCollum lowered a seismometer into a well in order to determine the form of the salt. A three-component seismometer is employed. Shot points are set 2000–3000 ft apart on lines radiating from the well. The seismometer is placed at the top of the salt or at the bottom of the well. The times of arrival coupled with a knowledge of the wave velocities in the salt and the sediments enable the form of the salt to be defined.

A detailed survey may take one to two weeks. It is desirable to make a preliminary interpretation of the data on the spot to ensure that all necessary observations are made.

For reasonably shallow domes the method can be applied even when the salt has not been penetrated. G. D. H.

252. Seismic Reflection Methods of Prospecting for Oil. E. I. Robertson. *Petroleum*, Sept. 1947, **10**, 196.—Reflection of seismic waves in geophysical prospecting is discussed theoretically and practically. F. W. H. M.

253. Geological Study of Gulf Coast Continental Shelf. Anon. *Oil Gas J.*, 13.12.47, **46** (32), 82.—The U.S. Geological Survey is carrying out gravity meter surveys nearly 75 miles offshore, and they may be extended to the edge of the continental shelf, 125 miles offshore. Information is being collected on bottom sediments, topography, temperature, and salinity.

The area under examination extends from long. 93° to long. 94°, and starts at lat. 27° 50′ N. There are a number of underwater hills in the outer part of the area. It is hoped to determine their nature. Over 200 stations have been surveyed at 2-mile intervals, and as many as 24 readings have been made in 26 hr.

Diagrams and photographs show the equipment and the technique employed.

G. D. H.

254. Patents on Geophysics and Geochemical Prospecting. Hughes and Son, Ltd., D. O. Sproule, and A. J. Hughes. B.P. 592,241, 24.9.47. Means for the detection and measurement of magnetic fields.

Texaco Dev. Corpn. B.P. 594,776, 3.12.47. Electric-discharge devices for use as radiation detectors.

C. Arnold (Standard Oil Dev. Co.). B.P. 595,313, 17.12.47. Method and apparatus for the recording of electrical impulses. G. R. N.

Drilling.

255. Heavy Duty Cementing Equipment Performs Wide Variety of Operations. N. A. D'Arcy, Jr. *Petrol. Engr*, Aug. 1947, **18** (12), 74.—A description is given of a new piece of cementing equipment which can be moved to the drilling well and used to carry out all types of cementing operations independently of the drilling equipment at the well. R. B. S.

256. Offshore Well Nears 12,000 ft. E. Short. *Oil Gas J.*, 29.11.47, **46** (30), 60.—Located 19 miles offshore in the Gulf of Mexico, Superior Oil Co.'s well recently reached 10,163 ft. Drilling equipment is practically the same as for standard inland drilling. A specially designed Schlumberger unit is being used, consisting of winch and cable and a recording unit. C. G. W.

257. Drilling Stresses Present in Cable-Tool Operations. J. F. Kendrick. *Oil Gas J.* 13.12.47, **46** (32), 80.—Stresses in drilling cable are due to (1) complex transient vibrations; (2) localized kinking; (3) excessive inertia caused by too high or too tight a hitch. Transient vibrations are initiated by the impact of the bit and are reflected back and forth along the drilling line. Typical dynamometer cards are shown and their characteristics explained on the travelling-wave concept. The transient vibration is responsible for the noise of cable-tool drilling which is louder with a tight or high hitch. In spite of the fact that a loose hitch drills faster than a tight hitch, many drillers tend to use a tight hitch owing to the signal being muffled or lost. The use of dynamometer cards to study drilling progress, might well result in the adoption of more efficient drilling conditions. Available evidence indicates that vibrations will not pass a splice. Hence cutting and splicing the lower 300 or 400 ft will confine destructive vibrations to a small section of cable. C. G. W.

258. Special Midget Rig Prepares Locations at Rangely. N. Williams. *Oil Gas J.*, 29.11.47, **46** (30), 69.—A light, truck-mounted drill digs the cellar, conductor hole, rat and mouse holes, and dead-men holes in advance of the big rig. The conductor hole is 20-in to accommodate 16-in pipe and the cellar has a maximum diameter 7 ft and depth 5 ft. Estimated time saving is 3 days on each well. The drill is a mechanized, bucket type post-hole digger. The bucket is about 3 ft long and diameter the size of hole to be dug. Radial cutting blades on the bottom deflect cuttings into the bucket while rotating. The bucket is run on a small kelly point suspended on the hoisting line. The cellar is started with a 36-in diameter hole and reamed in two stages, by cutting blade extensions. C. G. W.

259. Electric Log Interpretations. S. J. Pirson. *Oil Gas J.*, 6.12.47, **46** (31), 84.—This article concludes a series of articles on Electric Logging, and deals with interpretations of logs. The following points are discussed at length: (1) determination of lithology: (*a*) empirical interpretation of self-potential data; (*b*) empirical interpretation of resistivity data; (2) quantitative determination of porosity; (3) quantitative determination of effective permeability; (4) quantitative determinations of saturations. C. G. W.

260. Electrical Logging Developments in the U.S.S.R. I. Resistivity of Non-Invaded Formations. H. Guyod. *World Oil*, Dec. 1947, **127** (8), 231.—Departure charts show the relationship between the ratio of the apparent and mud resistivities and the ratio of electrode spacing to hole diameter for different ratios of true and mud resistivities. These charts permit the estimation of the true resistivity of a thick formation. The data required involve mud resistivity, hole diameter, electrode spacing, and apparent resistivity, but one or more of the earlier factors can be omitted if more

than one apparent resistivity measurement with different electrode spacings is available. The electrode arrangements must all be of the same type. The departure curves are employed in the interpretation, because there are disadvantages in using very wide electrode spacings. The conditions under which departure curves should be used with different electrode spacings are described.

Departure charts can be used in some cases for estimating hole diameter, and should be applied only in non-permeable formations for this purpose, because the departure curves described are for non-invaded formations. G. D. H.

261. Geological Interpretation of Radioactivity Well Logs. J. E. Kilkenny. *Petrol. Engr*, Aug. 1947, **18** (12), 137.—Brown organic shales have high radioactivity for sediments, and rhyolitic ashes and bentonites, especially if young, are still higher. Clean sands, limestones, and barren shales have low radioactivity. The high value in organic shales may be due to precipitation of colloidal radioactive matter with organic matter, to percolation of radioactive solutions after sedimentation, or to precipitation in enclosed basins.

Bentonite and ash markers are sharply marked on radioactivity logs, but they may not show on electric logs in the San Joaquin valley. Phosphatic nodules in the basal Etchegoin are radioactive. The Kreyenhagen organic shale is not highly radioactive. G. D. H.

262. New Gravel Packing Technique at Huntingdon Beach. H. David. *Oil Gas J.*, 13.12.47, **46** (32), 81.—By this method it is now possible to gravel pack two productive zones and effect a water shut-off in one operation. In this case the formation consisted of two productive sands with an intermediate shale. Midway in the shale is a prolific water sand. The job requires a lubrication pump, lead seal adapters, and a circulation joint. The joint consists of two concentric tubes. On the outside is a swab rubber opening downwards. Below the rubber are ports opening into the annulus and above the rubber are ports opening from the inner tube to the well bore. The well is drilled penetrating two producing zones and intermediate shale and water sand. A sleeve is cemented along the entire shale section. Casing is run to the top of the upper oil zone and cemented. The oil zones are then reamed. Perforated liner is run with blank liner overlapping the sleeve and a tail pipe run inside the liner. With the liner hung just off bottom, circulation is started and gravel introduced into the fluid stream. Fluid passes down the drill pipe through the ports into the well bore, into the liner and up the tail pipe. A pressure rise indicates that the whole of the perforated section of the liner is packed. Some of the blank section is packed to allow for settling, a lead-seal adapter set on top of the liner, and then the upper zone packed similarly. C. G. W.

263. Setting Multiple Packers. Anon. *Producers' Monthly*, Sept. 1947, **11** (11), 20.—A method of setting multiple packers is briefly described. This method was suggested at a recent meeting of the Practical Operating Methods Committee of the Bradford District Pennsylvania Oil Producers' Assoc'n. R. B. S.

264. Drilling Patents. Shell Dev. Co. B.P. 592,754, 8.10.47. Well-drilling fluid.

P. J. M. T. Allard. B.P. 596,715, 21.1.48. Method and means of tubing wells. G. R. N.

Production.

265. Penn Grade Progress on Use of Bacteria for Releasing Oil from Sands. J. V. Beck. *Producers' Monthly*, Sept. 1947, **11** (11), 13.—It is now well known that certain kinds of sulphate-reducing bacteria possess the property of being able to release crude oil from sand surfaces. Such release may be due to one of the following mechanisms: (1) the affinity of bacteria for solid surface may enable them to attach themselves to and grow upon the sand grains thus forcing the oil from the solid surface; (2) the production of surface-active materials by the bacteria, thus enhancing the possibility of oil displacement; (3) the production of carbon dioxide by the metabolic activities of the bacteria, resulting in the dissolution of calcareous matter and consequent release of oil which may have been attached to such matter; or (4) the reduction of the visco-

sity of the oil by the dissolution of such carbon dioxide in the oil. Laboratory tests which have been carried out to determine the advisability of bacteria-utilization projects for the recovery of oil from the Bradford sands are described.

Experimental work has indicated that : (1) sulphate-reducing bacteria utilize crude oil extremely slowly ; no decrease in quantity or quality of any sample of oil was noted as a result of bacterial activity, even after long periods of incubation ; (2) these bacteria are, however, able to grow using crude oil as a source of energy ; only one type of produced water in over seventy-five which were tested, was found to be inhibitory to their activity. Waters of low pH tended to be most unfavourable to bacterial activity ; (3) the rate of penetration by the bacteria of samples of the Bradford sand was found to be very slow for all the cultures used ; and (4) whilst some sulphate-reducing bacteria were found to be present in produced waters from old wells, there was no evidence of the presence of bacteria in sand cores obtained from wells being drilled in the Bradford area. Extensive studies were made of methods of actually displacing Bradford crude from samples of Bradford sand. Marine- and local-bacterial cultures were tested, and several different techniques were used. The results obtained were not encouraging, but the author states that sufficient indication has been obtained of the possibility of successful methods of bacterial displacement to justify further extensive studies of this nature. Four references are appended.

R. B. S.

266. Field-Calibration Technique for Bottom-Hole Pressure Measurement. E. R. Brownscombe. *Petrol. Engr*, Aug. 1947, **18** (12), 84. (*Paper presented before A.I.M.E.* Apr. 1947.)—The need for accuracy in bottom-hole pressure measurement is stressed : it is pointed out that in predicting reservoir behaviour it is the *reservoir pressure* rather than the *bottom-hole pressure* which is of importance. Since reservoir pressure is usually obtained by extrapolation of bottom-hole pressure data this emphasizes the need for accuracy in the latter. Some of the most common sources of error in bottom-hole pressure measurement are evaluated, and a description is given of a field-calibration technique for use in surveys for which particular precision is desired. Two references are given.

R. B. S.

267. Rustless Coupling for Asbestos Cement Pipe. F. Squires. *Petrol. Engr*, Aug. 1947, **18** (12), 178.—A rustless coupling for asbestos cement lead lines and casings for salt-water disposal wells is very briefly described. One reference is given.

R. B. S.

268. Conservation and Utilization of Natural Gas. R. E. Moyar. *Oil Gas J.*, 27.12.47, **46** (34), 251.—The operations refer to the La Brea–Parinas Estate of the International Petroleum Company, Ltd., on the Pacific Coast of N.W. Peru. The estate covers an area of 643 square miles, with five producing formations.

Some 330 billion cu. ft. of gas has been produced, 80% of this volume having been produced since 1927, and has been utilized, only 2½% being wasted.

39% of the residue gas has been injected into the Parinas sand for pressure-maintenance and repressuring operations. Efficient utilization of reservoir energy has been obtained from injected gas by introduction of gun-perforation methods for well completions. Proper distribution of injection wells, and recompletion of producing ones, has overcome problems caused by geological conditions.

The operation of Parinas sand pools under pressure maintenance has led to production of 95% of the ultimate yield by natural flow, and 65% of the ultimate recovery within 5 to 6 years after complete development.

G. A. C.

269. New Plant Combines Gas Lift and Repressuring. G. Weber. *Oil Gas J.*, 13.12.47, **46** (32), 96.—This plant has a capacity for compressing and dehydrating 10,000 million cu. ft. of low-pressure residue gas, discharging 5000 million cu. ft. at 300 p.s.i.g. for gas lift and 5000 million cu. ft. at 600 p.s.i.g. for pressure maintenance. Incoming gas is water-saturated at 30 p.s.i.g. and is very sour. The gas is scrubbed, and compressed in 3 stages to 300 p.s.i.g., being cooled and scrubbed at each stage. That required for gas lift is treated with diethylene glycol and then fed to the gas-lift system. The remainder is compressed to 600 p.s.i.g., cooled, scrubbed, and dehydrated, then metered to the field-injection system. Plant and equipment are described.

C. G. W.

270. Relative Permeability Measurements on Small Core Samples. R. A. Morse, P. L. Terwilliger, and S. T. Yuster. *Producers' Monthly*, Aug. 1947, **11** (10), 19.—It is now well known that the relative permeability of a given sand to any one of the several fluids which are present in it is dependant upon the saturation of those fluids, and for different sands the relative permeability will vary for a given fluid saturation. No extensive use has yet been made of the concept of relative permeability owing to the difficulty and expense incurred in obtaining the quantitative data which is necessary to apply this concept to actual field studies, but mathematical relationships have been derived from the fundamental studies to predict the performances of natural reservoirs under almost all possible conditions. In this paper a description is given of a simple apparatus which has been developed to enable a more rapid determination to be made of relative permeability measurements on small core samples as routine laboratory procedure.

The sample core is encased in Lucite (a methylmethacrylate polymer) and for fluid-flow tests is inserted between a mixing head and outlet assembly, both of which are similarly encased in Lucite and have similar diametrical measurements. The mixing head consists of two separate inlet chambers in the Lucite (one for each fluid), followed by a disc of highly permeable sand, a diaphragm of impermeable material with a central orifice, another disc of highly permeable sand, and finally a core taken from the same sandstone as the test core, to which a band electrode is attached. The outlet assembly consists of a core of the same sandstone, also fitted with a band electrode, and an outlet chamber. The sample core is fitted with band electrodes at each end and manometric connexions in the mixing head and outlet assembly are arranged in such a manner that the pressure at the extreme ends of the sample core can be measured when the apparatus is assembled. The mixing head, sample core, and outlet assembly are then clamped together by a quick-release spring-clamping assembly in such a way that the faces of the cores are brought into intimate contact and the Lucite casing seals the whole assembly. It is believed that the intimate core-to-core contact eliminates the boundary effects which would otherwise have considerable effect on such small samples, and also that the mixing head establishes simultaneous flow of the two fluids evenly distributed over the entire cross-section. The construction of the apparatus and the method of mounting in Lucite is described: the construction of the clamp was such that the retaining pressure could be instantly released and the sample core rapidly removed for weight determinations.

The experimental procedure adopted was as follows: (1) the cleaned and dried core, encased in Lucite, was accurately weighed; (2) the air permeability was determined; (3) the pore volume was determined by brine saturation; (4) the brine permeability and electrical conductivity was determined; and (5) the simultaneous flow of air or oil with the brine was then established, the air–brine or oil–brine ratios being controlled by needle valves in both injection lines. When equilibrium was established the produced fluids were collected for a measured time interval and the pressure drop and electrical conductivity were measured. After each run the core was weighed to determine the fluid saturations so that an electrical conductivity–brine saturation relationship could be established for subsequent determinations thus eliminating the necessity of withdrawing the core from the apparatus between test runs. From these data the relative permeabilities to the various fluids could be determined.

The results of tests on synthetic cores, cores of the second Venango sand, and cores of the Bradford sand, are presented and discussed and the rates and recoveries predicted by this method were shown to agree with the data obtained from more complex and time-consuming experiments on long cores. Seven references are appended.

R. B. S.

271. Optimum Spacing of Rows of Oil Wells in Sands under Hydrostatic Pressure. I. A. Charnyi. *Petrol. Engr*, July 1947, **18** (11), 135. (*Paper published in Izvestiya Akademii Nauk S.S.R., Otelenie Tekhnicheskikh Nauk, Bull. de L'Academii des Sciences de L'U.R.S.S., Classe des Sciences Techniques*, 1945 (1–2), 29–33. *Translated from the Russian by A. A. Boehtlingk.*)—Mathematical equations are developed to describe: (1) the movement of the oil–water contact under hydrostatic pressure in a sand of variable porosity and permeability; and (2) the distribution of drainage galleries (*cf.* rows of wells) in an oil sand of variable porosity and permeability under hydrostatic pressure when the time of extraction of the oil is to be a minimum. The actual spacing between the wells themselves, and economic considerations affecting the issue are not discussed.

R. B. S.

272. More Oil from Spent-Water Drives by Intermittent Air or Gas Injection. R. J. Pfister. *Producers' Monthly*, Sept. 1947, **11** (11), 10.—The recent trend towards increasing oil recovery from flooded sands by intermittent air or gas injection is discussed. A few experimental results are presented which serve to show the order of the increased recoveries to be expected. The introduction of air or gas into a flooded sand alters the movement of the water and affords redistribution of the oil. The well-defined air– or gas–water meniscus as compared with the ill-defined oil boundary also favours more complete wetting of the sand surfaces by water and subsequently better oil displacement. Gas injection ahead of a water flood will also enliven the crude and increase the ultimate recovery of the oil. R. B. S.

273. Secondary Recovery Production Research. R. V. Hughes. *Producers' Monthly*, Aug. 1947, **11** (10), 16.—The importance of secondary recovery research is stressed and very brief reviews are given of certain secondary recovery research programmes which are being undertaken in the U.S.A. at the present time. R. B. S.

274. Free Pump Latest Thing in Hydraulics. R. Sneddon. *Petrol. Engr*, Aug. 1947, **18** (12), 60.—See Abstracts Nos. 1811 and 1826 (1947).

275. Scrapers on Sucker Rods Reduce Paraffin Deposits. E. V. Garrett. *Petrol. Engr*, Aug. 1947, **18** (12), 132.—A method of keeping tubing free of paraffin deposits is described. Special scrapers are attached to the sucker rod at regular intervals and at depths corresponding to the parts of the tubing which are known to be subject to paraffin contamination. These scrapers are designed so that they remove paraffin deposits during the up-and-down motion of the rod string. They are used in conjunction with a rotary hanger : this is a rachet mechanism which causes the rods to rotate a fraction of a turn at each down stroke of the unit. R. B. S.

276. Field Test of Corrosion Inhibitors for Low pH Flood Water. J. N. Breston and K. Barton. *Oil Gas J.*, 6.12.47, **46** (31), 91.—Corrosion of water pipes considerably influences the economy of water flooding. Raising the pH of the water eliminates much corrosion, but other factors, such as plugging of the sand, bacterial activity, influence of pH on ion exchange, and hence on rate of water intake, demand a low pH. Laboratory investigations indicate that water-soluble salts of some amines inhibit corrosion in air-free waters of low pH. Controlled experiments on the effects of such salts are fully described and the results tabulated. These results indicate that with an inhibitor (rosin amine acetate) rate of corrosion, iron pick-up, and bacteria counts are reduced. C. G. W.

277. Electric Drive for Water Flood Recovery. W. G. Taylor. *Petrol. Engr*, Aug. 1947, **18** (12), 80.—The use of electric power in water-flood operations is discussed. Intermittent pumping can be achieved by one of three control methods, viz. : (1) using a float-switch or pressure switch in the raw-water receiving tank ; (2) using a time switch ; and (3) a combination of (1) and (2). R. B. S.

278. Production Patents. Indo-Burma Petroleum Co., Ltd., and N. F. Brown. B.P. 594,663, 26.11.47. Apparatus for raising natural oils and other liquids by gaseous pressure.

Indo-Burma Petroleum Co., Ltd., and N. F. Brown. B.P. 596,111, 7.1.48. Means for raising oil and other liquids by gas pressure. G. R. N.

Oilfield Development.

279. 58·9% of World Reserves Held by U.S. Firms. Anon. *World Oil*, Dec. 1947, **127** (8), 57.—The U.S.A. has produced more than 60% of the world's oil and in 1946 gave 62% of the world output. The U.S.A. has 38·3% of the proved world reserves of oil. American-controlled reserves are about 58·9% of the world total.

World reserves are placed at 63,189,037,000 brl, 24,194,587,000 brl being in the U.S.A. American holdings in foreign countries are estimated to involve reserves of 13,051,450,000 brl. The Anglo-Iranian Oil Co. and the Royal Dutch-Shell group hold proved reserves of 13,377,400,000 brl outside the U.S.A. These two companies together with American companies hold 80·1% of the world reserves. Cie Française des

Petroles holds 2·0% of the world reserves and Petroleos Mexicanos 1·3%. The Russian-held reserves amount to 12% of the world total.

The leading reserve-owning companies are Anglo-Iranian (9,165,950,000 brl), Standard (N.J.) (8,489,225,000 brl), and Royal Dutch-Shell (7,369,597,000 brl).

Tables give the domestic and foreign-reserve holdings of U.S. companies at the beginning of 1947, and the reserves held by important non-American oil companies.

G. D. H.

280. Completions in the U.S.A. Anon. *World Oil*, Oct. 1947, **127** (6), 78; Nov. 1947, **127** (7), 96; Dec. 1947, **127** (8), 88.—The U.S.A. well completion results for August, September, and October are summarized by States and districts. G. D. H.

281. Possibilities for Oil and Gas in New York. E. T. Heck. *Petrol. Engr*, Aug. 1947, **18** (12), 163. (*Paper presented before A.P.I., Pittsburgh*, June 1946.)—See Abstract No. 536 (1947).

282. Coryville Oil Pool, McKean County, Pennsylvania. R. W. Harding. *Producers' Monthly*, Aug. 1947, **11** (10), 26.—The geology and development of the Coryville Pool are described, and the available reservoir data is discussed. The manner in which this data has been utilized in order to determine the best method of production is also briefly described. R. B. S.

283. Pennsylvania Grade Industry During First-Half of 1947. G. G. Bauer. *Producers' Monthly*, Sept. 1947, **11** (11), 21.—Statistics pertaining to Penn Grade production and runs to stills are presented for the period Jan.–June 1947 together with comparative figures for 1946. Daily average production was 59,513·8 brl and crude runs to stills averaged 59,828·7 brl per day. Some 57,000 brl of Penn Grade crude were withdrawn from storage during the period, lowering the stocks of Penn Grade crude to 1,947,000 brl as of June 30, 1947. R. B. S.

Transport and Storage.

284. Cost of Leaks. W. L. Nelson. *Oil Gas J.*, 1.1.48, **46** (35), 69.—No. 177 of the *Refiner's Notebook* series gives tables, showing losses of air, steam, water, and fuel gas, through $\frac{1}{64}$- to $\frac{1}{4}$-in diameter holes; losses by oil leaks and audibility of leaks from faulty fittings. The audibility table shows that a noisy leak is not necessarily a large one. G. A. C.

285. Product Pipeline Metering Practices. M. J. Dabney. *Pipe Line News*, Dec. 1947, **19** (12), 11.—Details of the Plantation Pipe Line Co.'s pipeline system, including pressures and capacities, are briefly mentioned. Products from aviation-base stock to diesel fuel have been metered by the same equipment—a positive displacement meter. Positive displacement meters may be proved to 0·05% by the prover tank method, and it is possible to meter petroleum products with an accuracy of 0·05% if certain conditions are observed: (1) product must be free from foreign material; (2) flow rates maintained within the accuracy range of the meter; (3) viscosity and temperature corrections applied; (4) pressure is controlled; (5) pulsating flow avoided. Means of attaining these conditions are given and the pipeline practices of the company discussed in great detail. C. G. W.

286. World's Tanker Fleet. Anon. *Oil Gas J.*, 27.12.47, **46** (34), 228.—It is estimated that the world's tanker fleet totals 1868 vessels, with an average speed of 13·10 knots. The U.S. fleet numbers 354 vessels, with 167 in the inactive fleet, 176 in trade, and remainder leased.

World fleet tonnage amounts to 21,315,000 dead weight tons. In terms of T-2 equivalents the world tanker fleet now totals 1271. G. A. C.

287. Patents on Transport and Storage. Chicago Bridge and Iron Co. B.P. 593,800, 5.11.47. Storage vessels.

Chicago Bridge and Iron Co. B.P. 595,135, 10.12.47. Pressure vessels or containers.

G. R. N.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

288. Equipment Protection for Cracking Units. E. Q. Camp. *Oil Gas J.*, 29.11.47, **46** (30), 83.—The corrosion encountered, and methods employed in its mitigation, in cracking reduced sour crudes and sour distillates is discussed. Corrosion experienced in operation of three cracking processes : (*a*) thermal cracking of reduced West Texas crude, (*b*) cracking of sour distillate in a fluid catalyst cracking unit, and (c) vapour-phase reforming of a light naphtha are dealt with. Corrosion is likely to be severe in thermal cracking units with this crude and steps have to be taken to combat it.

In the furnace, tubes of 18-8 alloy metal were used, the same metal being used in hot-oil lines and other positions. The injection of 6 lb of caustic soda per 1000 brl of crude resulted in appreciable reduction in corrosion of the unit in which residuum from the pipe still is processed. Corrosion, as such, is not a significant problem in the operation of fluid catalyst cracking units, but corrosion of an intergranular type occurred in reactor vapour lines, eliminated by removing carbon-steel wear plates from all 18-8 alloy steel tubes and vessels.

In vapour-phase cracking it was found that all corrosion experienced in operations at elevated temperatures is not necessarily due to sulphur or its compounds, and appreciable quantities of sulphur are extremely effective in reducing corrosion of 18-8 alloy furnace tubes in high-temperature cracking service. Several exploratory corrosion tests were made to establish cause of corrosion, but without success.

G. A. C.

289. New Furfural Solvent Lube Plant. L. C. Brown and C. F. Tears. *Petrol. Process.*, July 1947, **2** (7), 492.—A new furfural solvent treating plant for lubricating oil production has been completed at Coffeyville, Kans., for the Co-operative Refinery Assn. It has been designed to process 2200 brl/day of dewaxed neutral oil or 1050 brl/day of dewaxed acid-treated bright stock, involving a daily loss of only 0·06% of solvent. Several novel features are included in this new plant among which is the elimination of surge tanks for raffinate and extract mixes from the treating tower by operating the tower at a pressure of 75 p.s.i.g., which is sufficient to deliver both the extract and raffinate mix to the succeeding steps of the operation. Other outstanding features are the careful control of the outlet temperature at the extract heater and the large number of cases where instrumentation has been employed to indicate operating conditions and enable them to be closely controlled. O. M.

290. Engineering Completed for New $15,000,000 Petrochemical Plant to be Built on Gulf Coast. J. E. Bludworth. *Oil Gas J.*, 1.1.48, **46** (35), 48.—Chemical processing units utilizing natural gas and costing over $15,000,000 are to be constructed 1948–49 by McCartly Chemical Co. at Winnie, Tex.

Units for the production of aromatic and unsaturated hydrocarbons and secondary products will be in operation in first half of 1948. Plant will cover 50 acres, with addition acreage on the tidewater. By late 1948, capacity will reach 250,000 million cu. ft/day. Aromatic products will total 200,000 lb/day and liquified petroleum gases some 220,000 gal/day.

Carbon steel, and stainless steel where necessary, will be used in construction. Water is available at 200 ft depth and from Neckes River. Steam requirements will be 200,000 lb/hr supplied by " outdoor " steam plant. G. A. C.

291. Patents on Refineries and Auxiliary Refinery Plant. J. C. Arnold (Standard Oil Dev. Co.). B.P. 592,187, 24.9.47. Prevention of corrosion in equipment for the distillation of sulphuric acid-treated hydrocarbons.

A. C. Price (J. C. Hobbs). B.P. 592,273, 24.9.47. Separators for gaseous fluids and liquids.

Lummus Co. B.P. 592,485, 1.10.47. Construction of fractionator plates.

Foster Wheeler Ltd. B.P. 593,824, 5.11.47. Heat exchange apparatus.

C. Arnold (Standard Oil Dev. Co.). B.P. 595,457, 17.12.47. Continuous contact process for carrying out hydrocarbon reactions. G. R. N.

Distillation.

292. New Gasoline Plant. E. Short. *Oil Gas J.*, 13.12.47, **46** (32), 48.—This plant has an intake capacity of 30–40 million cu. ft. of gas per day.

Wet gas is gathered from 660 wells in the Hastings field through 35 miles of lines to 160 tank batteries and separators. The plant takes gas at pressures varying from 10 p.s.i.g. to 10 in vacuum, and can finally discharge it at 5000 p.s.i.g. if required, although a pressure of 3500 p.s.i.g. is normal. Gas from compressors is passed to absorbers, to produce 46,000 gal of liquid products per day, and unused remainder is compressed for delivery to input wells for storage in water sand.

Propane, butane, natural gasoline, and *iso*-pentane are the products. G. A. C.

Solvent Extraction and Dewaxing.

293. Patent on Distillation. J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,463, 29.10.47. Separation of aromatic hydrocarbons from their mixture with other hydrocarbons. G. R. N.

Cracking.

294. Recent Developments in the Cycloversion Process. C. J. Helmers, P. H. Johnson, and C. M. Brooner. *Oil Gas J.*, 13.12.47, **46** (32), 88.—Some representative data from a study of the effects of pressure, catalysts, and feed stocks as related to product quality and yield, made in semi-commercial and pilot-plant development work on the Cycloversion process for the past several years, are presented.

The results are tabulated, and from them, for example, it is shown that the presence of straight-run naphtha in the gas-oil charge has a marked effect on the octane rating of the catalytically cracked gasoline; there being a reduction of rating.

The result of Cycloversion tests of decarbonized Panhandle topped crude shows a 5% distillation temperature of 915° F and a 60% temperature of slightly over 1100° F; a diluent rate of 30–50 lb of steam per brl of heavy oil will give optimum results when operating at a chamber pressure of 10 lb. G. A. C.

295. Lion Completes its New Streamlined T.C.C. Unit. A. B. Tuttle. *Oil Gas J.*, 20.12.47, **46** (33), 65.—The simplified and streamline Thermofor catalytic-cracking unit incorporated into existing facilities at the El Dorado, Ark., Refinery of the Lion Oil Co., is described. Flow of treated virgin gas oil to the catalyst is about 5400 brl/day, the charge stock being passed through a superheater to raise its temperature to 910° F on its way to the T.C.C. reactor where the vaporized material travels downward in concurrent flow with the catalyst. Synthetic head-catalyst is used. Cracked hydrocarbon vapours are sent to a low-pressure fractionator for separation into overhead, bottom, and side-cut products.

The C_4 and lighter products are further processed in the refinery's vapour recovery and catalytic polymerization units. The new T.C.C. plant equipment is constructed of various alloy materials; for instance, all heater tubes operating at temperatures below 690° F are of carbon steel.

For fire prevention an inert gas system is tied into various points in the unit. G. A. C.

296. Patents on Cracking. International Catalytic Oil Processes Corpn. B.P. 592,190, 24.9.47. Method of carrying out catalytic reactions.

Universal Oil Products Co. B.P. 592,310, 24.9.47. Catalysts and process for their manufacture.

Houdry Process Corpn. B.P. 592,437, 1.10.47. Catalysis.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 592,494, 1.10.47. Catalytic conversion of hydrocarbons.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,041, 22.10.47. Catalytic cracking of oil to obtain gasoline.

Standard Oil Dev. Co., and J. C. Arnold. B.P. 593,185, 22.10.47. Vapour phase catalytic reactions.

C. Arnold (Standard Oil Dev. Co.). B.P. 593,418 and 593,496, 29.10.47. Cracking process.

Shell Dev. Co. B.P. 593,778, 5.11.47. Catalytic conversion of oils.

Shell Dev. Co. B.P. 593,849, 12.11.47. Preparation of catalysts.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 594,407, 26.11.47. Clay catalysts.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 594,569, 26.11.47. Catalytic aromatization process.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 594,667, 26.11.47. Regeneration of catalysts.

J. C. Arnold (Standard Dev. Co.). B.P. 594,982, 3.12.47. High-temperature cracking process.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 595,001, 10.12.47. Catalytic conversion of hydrocarbons.

Anglo-Iranian Oil Co., Ltd., and F. W. B. Porter. B.P. 595,037, 10.12.47. Dehydrogenation and hydrofining of naphthas.

Standard Oil Dev. Co. B.P. 595,055, 10.12.47. Catalytic conversion of hydrocarbons.

C. Arnold (Standard Oil Dev. Co.). B.P. 595,453, 17.12.47. Separation of powdered solids from gases.

Shell Dev. Co. B.P. 595,742, 24.12.47. Preparation of catalysts and catalytic conversion of hydrocarbons.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 595,766, 2.1.48. Catalytic conversion of hydrocarbons.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 596,434, 14.1.48. Destructive hydrogenation of hydrocarbons.

Universal Oil Products Co. B.P. 596,591, 21.1.48. Manufacture of inorganic-oxide particles of spherical shape.

Shell Dev. Co. B.P. 596,616, 596,618–9, 596,829, 21.1.48. Dehydrogenation catalytic cracking and catalyst manufacture.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 596,758, 21.1.48. Dehydrogenating catalysts.

C. Arnold (Standard Oil Dev. Co.). B.P. 596,872, 28.1.48. Catalytic conversion of hydrocarbons.

C. Arnold (Standard Oil Dev. Co.). B.P. 597,086, 28.1.48. Dehydrogenation of hydrocarbons.

W. G. Evans, assr to Universal Oil Products Co. U.S.P. 2,413,961, 7.1.47. Manufacture of catalysts in pellet form having a low density and high thermal stability.

G. R. N.

Polymerization.

297. Patents on Polymerisation. J. C. Arnold (Standard Oil Dev. Co.). B.P. 592,306, 24.9.47. Low-temperature olefin polymerization.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,636, 22.10.47. Modified olefin polymers.

C. Arnold (Standard Oil Dev. Co.). B.P. 593,699, 5.11.47. Production of olefinic polymers.

J. C Arnold (Standard Oil Dev. Co.). B.P. 593,744, 593,797, 5.11.47. Low-temperature polymerization of olefins.

C. Arnold (Standard Oil Dev. Co.). B.P. 595,120, 10.12.47. Olefin polymerization by a slow-moving catalyst.

Shell Dev. Co. B.P. 595,721, 24.12.47. Polymerization of methylpentadienes.

Shell Dev. Co. B.P. 596,564, 21.1.48. Process and products relating to rubber-like co-polymers.

G. R. N.

Alkylation.

298. Patents on Alkylation. Standard Oil Dev. Co. B.P. 592,184, 24.9.47. Alkylation of aromatic hydrocarbons.

Socony-Vacuum Oil Co., Inc. B.P. 592,212, 24.9.47. Alkylation of paraffins with olefins.

Universal Oil Products Co. B.P. 592,345, 1.10.47. Catalytic alkylation of *iso*-paraffins.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 596,777, 21.1.48. Catalytic alkylation of paraffins and olefins.

F. E. Frey, assr to Phillips Petroleum Co. U.S.P. 2,413,759, 7.1.47. Alkylation of paraffins using sulphuric acid containing aluminium sulphate. G. R. N.

Isomerization.

299. Patents on Isomerization. Shell Dev. Co. B.P. 592,213, 24.9.47. Isomerizing hydrocarbons.

C. Arnold (Standard Oil Dev. Co.). B.P. 592,446, 1.10.47. Isomerization of paraffins.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,989, 12.11.47. Vapour-phase isomerization processes.

Anglo-Iranian Oil Co., Ltd., E. W. M. Fawcett, and E. S. Narracott. B.P. 595,706, 24.12.47. Production of branched-chain paraffins from normal aliphatic hydrocarbons.

C. C. Crawford, W. E. Ross, and H. H. McAllister, assrs to Shell Dev. Co. U.S.P. 2,413,691, 7.1.47. Production of neohexane by catalytic isomerization. G. R. N.

Chemical and Physical Refining.

300. Patents on Chemical and Physical Refining. Midland Tar Distillers, Ltd., and F. G. Broughall. B.P. 593,665, 5.11.47. Refining hydrocarbons by fractional distillation.

Aktiebolaget Separator-Nobel. B.P. 595,014, 10.12.47. Method of refining mineral oils.

Yorkshire Tar Distillers, Ltd., and D. W. Milner. B.P. 595,406, 17.12.47. Separation of phenols from hydrocarbon distillates.

C. Arnold (Standard Oil Dev. Co.). B.P. 596,399, 14.1.48. Solvent extraction of mineral oils.

C. Arnold (Standard Oil Dev. Co.). B.P. 596,915, 28.1.48. Removal of diolefins from hydrocarbon mixtures.

Aktiebolaget Separator Nobel. B.P. 596,982, 28.1.48. Removal of wax from mineral oils, tars, and their products.

F. E. Frey, assr to Phillips Petroleum Co. U.S.P. 2,413,868, 7.1.47. Removal of organically combined fluorine from hydrocarbon mixtures.

H. J. Hepp, assr to Phillips Petroleum Co. U.S.P. 2,413,871, 7.1.47. Removal of organically combined chlorine from hydrocarbon mixtures.

C. E. Adams and T. B. Jom, assrs to Standard Oil Co. (Ind.). U.S.P. 2,413,938, 7.1.47. Extraction of acidic substances from hydrocarbon distillates by an alkali hydroxide containing an alkali-metal salt of a carboxy ether.

J. A. Bolt, assr to Standard Oil Co. (Ind.). U.S.P. 2,413,945, 7.1.47. Sweetening petroleum distillates using a solutizer process. G. R. N.

Special Processes.

301. Fluidization in Non-Catalytic Operation. R. P. Kite and E. J. Roberts. *Chem. Engng*, 1947, **54** (12), 112–115.—A description is given of the application of fluidization to limestone calcination. Other possible uses are indicated such as oxidation, reduction, ore roasting, sulphating (copper oxide to sulphate), and heat-transfer operations. Uniformity and close control of temperature are striking advantages whilst the principal limitation is that no softening or fusion of the solid particles must occur.

E. B.

302. Carbon Black. F. H. Burstall, F. G. Lane, and J. B. Ditcham. *Coke & Gas*, May and June 1947.—This is a reprint of a paper in two parts, on experimental researches on the production of carbon black from tar products and petroleum residues by an impingement process. Results show, that by using such a process, carbons suitable for reinforcing rubber and comparable with medium or coarse grades of American blacks can be made.

The apparatus consists of a vaporizer system for generating the enriched gas, and the burning and collecting equipment. Materials used included various fractions of coal tar such as crude naphthalene, anthracene oil, creosote, tar acids, road tar and pitch, pitch grease, a waste wash oil, a number of petroleum residues, and a coalite oil from the low-temperature process.

Factors affecting yield and quality include type and size of burner, distance between burner tip and surface, concentration of oil in carrier gas, type of oil used for enrichment, type of carrier gas used, temperature and pressure, draughting, and cleanliness. A table shows yields from various starting products.

Part II describes tests on the products, including moisture, ash content, acetone-soluble material, adsorption of diphenyl-guanidine and approximate particle size, the results being tabulated. Road tests on tyres incorporating the blacks, indicated that a product of satisfactory quality for rubber reinforcement can be obtained from tar products and certain petroleum residues.

G. A. C.

303. Esso's Fluid Catalyst Modifies Fischer–Tropsch. J. A. Lee. *Chem. Engng*, 1947, **54** (10), 105–107.—In the conventional Fischer–Tropsch process the pelleted or granular cobalt catalyst lies between tubes in the reactor. A 10,000 brl/day (synthetic gasoline) plant has 128 reactors with a total cooling surface of $5{\cdot}8 \times 10^6$ sq. ft. Investment cost in Germany was $8000 brl/day of products and the gasoline was below present U.S. standards. Standard Oil Dev. Co. introduced a fluid catalyst thereby reducing the number of reactors to six and the cooling surface to 35,000 sq. ft. for a 10,000 brl/day plant. Three pilot plants (largest 5–10 brl/day) are being operated at Baton Rouge. Synthesis gas is produced from natural gas, steam, and CO_2, but partial oxidation of the natural gas will be used on a commercial scale. An iron catalyst produced more gasoline and of higher quality than the more expensive cobalt catalyst. Quantities of chemicals are also formed, chiefly the lower alcohols and fatty acids with some acetaldehyde and acetone. The finely powdered catalyst fills the space around the cooling tubes and reactors. Synthesis gas is forced in at the bottom and the high heat of reaction ($1{\cdot}7 \times 10^6$ B.Th.U/brl of liquid products) is distributed to all parts of the reactor by the catalyst. Even with the high-heat evolution, temperature control of catalyst has been a major obstacle to low-cost production. Cyclone separators will probably be specified for the large-scale plant, but filters have been used for separating the catalyst. The mildly treated gasoline has O.N. (A.S.T.M.) 80. Cost of 8300 brl/day gasoline, 1050 brl/day gas-oil plant is estimated at $\$35 \times 10^6$ exclusive of cost of recovery plant for oxygenated products; thus gasoline can be produced at a competitive price.

E. B.

304. Catalytic Dehydrogenation of Ethylbenzene (2). Chemical Equilibrium in Styrene Formation from Ethylbenzene at Low Pressures. J. C. Ghosh, S. R. D. Guha, and A. N. Roy. *Petroleum*, Aug. 1947, **10**, 180.—In this second article, results are given of experiments carried out with various catalysts at atmospheric pressure. The best yields of styrene were given with a catalyst Cr_2O_3 (70%), Al_2O_3 (15%), Cu (15%). In view of this the authors have determined the equilibrium constants of the reaction at pressures of 10–50 mm and temperatures of 360–500° C in the presence of this catalyst.

The apparatus and procedure are given in detail.

F. W. H. M.

305. Liquid Fuels from Bamboo. L. Piatti. *Schweiz. Arch. Ang. Wiss. Tech.*, 1947, **13**, 370–376.—After a brief review of the production of liquid fuels from cellulose raw materials a description is given of a process operated in Indo-China during World War II for obtaining I.C. engine fuels from bamboo. The raw material was the caustic black liquor from a cellulose factory, which was processed on a pilot-plant scale. The yield of oil (60 kg/day) was 40 kg/ton dry bamboo. The "crude oil" obtained (d_{20} 0·880, b.p. 50–350° C) was cut into fractions to yield a light solvent (56–76° C), gasoline (56–125°), kerosine (125–150°), light (150–230°), and heavy (230–280°) diesel fuels, fuel oil (280–320°), and pitch. The main product was diesel oil; inspection data are given on the raw and refined fuel, together with details of the refining treatment used. The diesel oil gave better results than vegetable oils whilst the kerosine fraction had marked insecticidal properties. A flow-sheet of the plant is given. V. B.

306. Patents on Special Processes. C. Arnold (Standard Oil Dev. Co.). B.P. 592,281, 24.9.47. Manufacture of tertiary isomers of olefins.

G. Riethof. B.P. 592,384, 1.10.47. Distillation processes.

Imperial Chemical Industries, Ltd., J. G. M. Bremner, D. G. Jones, and R. R. Coats. B.P. 592,919, 15.10.47. Removal of water from organic compounds by distillation.

N.V. Inter. Hydro. Mij. B.P. 593,527, 29.10.47. Production of aviation gasoline.

Universal Oil Products Co. B.P. 593,903, 12.11.47. Conversion of *iso*paraffins into higher-boiling derivatives.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,910, 12.11.47. Catalytic synthesis of hydrocarbons from carbon monoxide and hydrogen.

Standard Oil Dev. Co. B.P. 593,940, 12.11.47. Catalytic synthesis of liquid hydrocarbons.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 594,009, 12.11.47. Production of aviation gasoline.

Shawinigan Chemicals Ltd. B.P. 594,641, 26.11.47. Production of carbon black.

Distillation Products Inc. B.P. 594,900. 3.12.47. High-vacuum distillation process and apparatus.

Anglo-Iranian Oil Co., Ltd., F. A. Fidler, and R. A. Dean. B.P. 594,983, 3.12.47. Production of aromatic hydrocarbons.

Distillation Products Inc. B.P. 595,096, 10.12.47. Apparatus for distillation.

Distillation Products Inc. B.P. 595,142, 10.12.47. Vacuum bodying process.

Anglo-Iranian Oil Co., Ltd., W. A. Partridge, and H. J. Alty. B.P. 595,814, 2.1.48. Production of motor fuels.

Anglo-Iranian Oil Co., Ltd., and D. A. Howes. B.P. 595,827, 2.1.48. Production of motor or aviation fuels.

Standard Oil Dev. Co. B.P. 596,162, 14.1.48. Catalytic syntheses of liquid hydrocarbons.

Anglo-Iranian Oil Co., Ltd., and D. A. Howes. B.P. 596,357, 14.1.48. Production of high-grade aviation and motor fuels.

Distillation Products Inc. B.P. 596,392, 14.1.48. High-vacuum unobstructed path fractionating processes.

Anglo-Iranian Oil Co., Ltd., E. W. M. Fawcett, and E. S. Narracott. B.P. 596,776, 21.1.48. Processing of hydrocarbons.

Shell Dev. Co. B.P. 597,029, 28.1.48. Controlled oxidation of paraffinic hydrocarbons and partially halogenated derivatives. G. R. N.

Metering and Control.

307. Theory of Automatic Control Systems. M. A. Melvin. *J. appl. Phys.*, 1947, **18**, 704–722.—After a description of terminology, the first part concerns itself with simple robots, the theory of which is equivalent to that of non-linear springs with inertia and friction. Optimum performance curves are drawn for both on–off and proportional robots and their use illustrated by practical examples.

In the second part, the theory of proportional robots is analysed, special emphasis being placed on the conditions for optimum performance. D. F. J.

308. Continuous Viscosity Measurement. W. A. Diament. *Chem. Engng*, 1947, **54**, (11), 136–137.—Two floats, one immune to the effects of varying fluid viscosity, the other a conventional plumb-bob type sensitive to viscosity changes, have been combined in one instrument after perfection of the "Bead guide" metering tube. By calibrating the instrument in K.D.U. (Kine Dynamic Units) it is possible to use it for fluids whose sp. gr. deviate from the calibrated density. Viscosities in centipoises are calculated from the observed K.D.U. and the sp. gr. of the fluid. Viscosities between 200 and 80,000 centipoises may be measured in a non-tapered tube in which a cylindrical rod type of float is used. Constant feed rate is desirable, but a simple correction may be applied for different rates. E. B.

309. Patent on Metering and Control. Universal Oil Products Co. B.P. 594,286, 19.11.47. Method and apparatus for controlling fractional distillation. G. R. N.

Safety Precautions.

310. Tars, Pitches, and Waxes and Their Dangers. P. Bouyeure. *Chim. et Ind.*, 1948, **59**, 87–89.—A brief account of some of the health hazards (chiefly cancer and dermatitis) involved in the use of these materials. V. B.

PRODUCTS.

Chemistry and Physics.

311. Adsorption of Gases on Surfaces of Powders and Metal Foils. R. T. Davis, Jr., T. W. DeWitt, P. H. Emmett. *J. Phys. Coll. Chem.*, 1947, **51**, 1232–1248.—The adsorption of various gases, including *n*-butane and 1-butane, on solids has been measured. The isotherm for *n*-butane is of the S-shaped type. D. F. J.

312. Adsorption of Argon, Nitrogen, and Butane on Porous Glass. P. H. Emmett and M. Cines. *J. Phys. Coll. Chem.*, 1947, **51**, 1248–1262.—Adsorption and desorption curves have been obtained for butane on five different samples of glass at 0° C. Pore radii are compared with valves obtained by applying the Kelvin equation to the desorption isotherm, and by applying the Cohan equation to the adsorption isotherm. D. F. J.

313. Dissociation and Unreleased Energy in Carbon Monoxide Explosions. A. Smeeton Meah. *Phil. Mag.*, 1947, **38**, 301.—The dissociation in carbon-monoxide explosions is considerable and the unreleased energy is dependent on the initial pressure, the nature of the diluent gas, and the size of explosion vessel. Such behaviour is therefore similar to that of mixtures in which dissociation is not significant.

The unreleased energy is due to latent energy and abnormal dissociation, and these are investigated. The extent of abnormal dissociation is determined by extrapolation of the observed equilibrium data by means of a semi-empirical formula. In the optimum case of a combining proportion of carbon monoxide and air, about half of the unreleased energy is due to abnormal dissociation and the rest due to latent energy. J. T.

314. One-Dimensional Theory of Steady Compressible Fluid Flow in Ducts with Friction and Heat Addition. B. L. Hicks, D. J. Montgomery, and R. H. Wasserman. *J. appl. Phys.*, 1947, **18**, 891–902.—The development of jet- and rocket-propulsion power plants requires adequate knowledge of the theoretical mechanics of dibatic (non-adiabatic), frictional, varjable-area compressible fluid flow. The well-known differential equations for this type of flow are simplified on the basis of the one-dimensional approximation. The variables in the final equations are press, temperature, and the local Mach number *M*.

It is shown that, in general, a solution to the equations exists whose calculation requires knowledge only of the variation with position of any three of the dependent variables of the system. The direction of change of the flow variables can be obtained directly from the equations without integration, and is determined for two special flows.

In the particular case when $M = 1$, a special condition must be satisfied by the flow if a solution is to exist. It is also shown that choking is related to restrictions imposed on the variables by the form of the equations. D. F. J.

315. Heat Flow in an Infinite Medium Heated by a Cylinder. C. J. Tranter. *Phil. Mag.*, 1947, **38**, 131.—Solution of a heat-conduction problem, where an infinite medium is heated by a long, circular cylinder is carried out by the method of Laplace transform. Numerical results for the case where the thermal conductivity of the cylinder is large are given. J. T.

316. Interfacial Tension by the Ring Method. The Benzene–Water Interface. H. L. Cupples. *J. Coll. Phys. Chem.*, 1947, **51**, 1341–1345.—Measurements have been made at 25° C of the interfacial tension of the mutually saturated benzene–water system using a du Nuoy interfacial tensiometer and applying the appropriate Harkins F-factor. The average of the eighteen measurements made is 32·67 $\pm$ 0·5 dynes/cm, a value 2·01 dynes/cm lower than the generally accepted value. D. F. J.

317. Oxidation of Mineral Oils. H. Stäger. *Schweiz. Arch. Ang. Wiss. Tech.*, 1947, **13**, 257–268, 289–299, 344–356, 376–379.—Oxidizing conditions encountered by mineral oils in industrial use, and the principal theories regarding the oxidation of pure hydrocarbons, are reviewed. Examples are shown of typical oxidation reactions of simple aliphatic and aromatic compounds. The hydroxyl and peroxide theories of hydrocarbon oxidation and also the more recent hydroxyl-peroxide theory are outlined; the latter is mainly concerned with explaining the oxidation mechanism occurring at the start of a reaction. These theories are illustrated by typical reaction schemes; the chain-reaction mechanism in hydrocarbon oxidation is mentioned in connexion with reaction kinetics. Applicability of rules governing pure hydrocarbons to complex mixtures such as mineral oils is, however, limited.

The hydrocarbon group analysis scheme of Suida and Pöll is indicated; the groups thus separated can be further characterized by Grignard's reagent. Measurement of dipole moments has given valuable clues to molecular structure; in hydrocarbon mixtures measurement of the dipole moment of individual compounds is not feasible, but the power factor of the mixture provides an indication.

The author proceeds to discuss insulating oils, and shows the difference in oxidation reactions between highly, medium, and poorly refined oils. The highly refined oils have no induction period and start oxidizing immediately. There is no formation of oil-insoluble products (sludge), the oxidation products being of lower mol. wt. and giving rise to high acidity. The presence of peroxides in oil reduces the tensile strength of cellulosic insulating materials coming into contact with it. Graphs illustrate the difference in behaviour between paraffinic and naphthenic transformer oils on oxidation.

Certain metals have a catalytic influence on oil oxidation, copper causes the formation of dicarboxylic acids whilst lead (and cadmium) favour formation of hydroxy monobasic acids. The results of long-term (28 months) field trials of transformer oils are given in terms of power-factor losses and dielectric-constant variations. The occurrence of an induction period can be clearly followed by means of power-factor measurements. A study of these results indicates that earth treatment is adequate for transformer oil regeneration inasfar as the removal of electrically undesirable products is concerned.

The second part of the paper concerns the behaviour of I.C. engine oils, with special reference to diesel oils. Diagrams depict temperature distribution at the cylinder walls and piston, and photographs show the appearance of the oxidation products as deposited on various engine parts. A laboratory oxidation test is described wherein oil flows between two electrically heated plates, in the presence of an air stream, until oxidation has progressed to such an extent that flow is interrupted. Comparative tests indicate that this apparatus gives results closely similar to those obtained in engine practice. Tests were carried out at temperatures of 150–245° C and for durations of 19–516 hr on paraffinic, naphthenic, and mixed-base oils (not further defined), and on oils containing polyfunctional additives. The oxidation products were subjected to successive extractions with alcohol, petroleum ether, benzene, and chloroform, and elementary analyses (C,H,O) of each fraction determined. The results are sum-

marized graphically. Paraffin-base oils showed a smaller viscosity increase on oxidation than naphthenic; removal of the petroleum ether insoluble portion (which should not be termed "hard asphalt") restored the viscosity to nearly the original figure. Acidity increase was more rapid for paraffinic oils. The proportion of alcohol-soluble products was higher in the inhibited oils. Comparative analyses were done on deposits from marine diesels in actual operation and from laboratory ageing tests, the closely similar results being shown graphically. It appears that 180° C marks a change in oxidation conditions, the nature of the reaction changing at higher temperature. The greater preponderance of alcohol soluble oxidation products at 180° C, in the case of paraffin-base oils, points to a relatively extensive oxidation of the side chains. In the case of both oils, the proportion of alcohol-soluble oxidation products is a maximum at 180° C. Deposits from a marine steam engine (cylinder-wall temperature 250–270° C, slide-valve temperature 330° C), lubricated with a naphthenic oil, were also examined as were those from an air compressor operating at 206° C and 6 atmospheres.

Results of both laboratory and engine tests are graphically summarized, and indicate a regular variation of the course of oxidation with temperature, except in the case of the air compressor, where increased oxygen pressure causes results to be similar to those normally obtained at higher temperatures. The variation in dielectric losses (at 20, 90, and 150° C) in the frequency range $5 \cdot 10^4$ to 10^7 Hz was measured for oxidized paraffinic and naphthenic lubricating oils. Response to frequency variation is more marked at higher temperatures and for the naphthenic oils.

Removal of the petroleum ether insoluble from oxidized oils reduces the power factor, especially at higher temperatures. Electron diffraction diagrams for both types of oils are reproduced.

Laboratory oxidation tests (as for lubricating oils) were carried out on diesel fuels (7 types). The results obtained were of a similar character, although oxidation took place more rapidly. Examination of the oxidation deposits from fuels show that petroleum ether insoluble determinations on the original material are no guide to the amount of insoluble residue deposited on oxidation.

The use of gas turbines is briefly discussed, especially with reference to the effect of the presence of H_2, H_2S, and SO_2 in the fuel on the metal parts. The ash content of oil fuels is considered and triangular m.p. diagrams for ash components are given, as well as detailed analyses of ashes from light and heavy fuel oils. V. B.

318. Derivation of Variable Specific-Heat Expressions for Thermal Efficiency and Calorific Value of Working Fluid, for Use in Internal Combustion Engine Design. C. Rogers. *Phil. Mag.*, 1947, **38**, 134.—Expressions are worked out for $\frac{H}{1+y}$ and η used in the calculation of the indicated mean effective pressure of an I.C. engine. H is the calorific value of the fuel, y is the air to fuel ratio and η, is the variable specific heat thermal efficiency. The investigations cover various types of combustion cycles including the basic, dual-combustion, diesel, constant-volume, and constant-pressure cycles. J. T.

319. A Problem on the Conduction of Heat. A. G. Walthers. *Phil. Mag.*, 1947, **38**, 70.—A long tubular body containing still air is inside, and concentric with a long steel tube which has a thin refractory lining. There is an air space between the body and the tube. The whole system is heated to a uniform temperature and is allowed to cool in air which may or may not be at rest. This problem is solved by means of a procedure analogous to the Kneser–Sommerfeld series expansion. J. T.

320. Mechanism of Processes Initiated by Excited Atoms. III. Photo-Sensitized Hydrocarbon Reactions. K. J. Laidler. *J. Chem. Phys.*, 1947, **15**, 712–726.—The photo-sensitized reactions of the hydrocarbons are discussed in terms of a reaction scheme. The relative rates of the reactions are discussed with reference to the experimental data, particular regard being paid to the energy relationships, the general kinetic behaviour, and the influence of temperature. Evidence is adduced in favour of the following: (1) the strength of the C–H bond in ethylene is *ca.* 100 kcal, (2) there is a triplet-excited state of acetylene with an excitational energy of 10–30 kcal, (3) conversion of a large amount of electronic energy into vibrational energy proceeds with difficulty, the process taking place much more readily when some of the energy can be taken up as electronic energy of the colliding molecule. D. F. J.

321. Infra-Red Spectrum and Depolarization Factors of the Raman Lines of Spiropentane and the Raman and Infra-Red Spectra of 1 : 1-Dimethyl*cyclo*propane, 1-Methyl*cyclo*butene, and Methylene*cyclo*butane. F. F. Cleveland, M. J. Murray, and W. S. Gallaway. *J. Chem. Phys.*, 1947, **15**, 742–758.—Selection rules for spiropentane and 1 : 1-dimethyl*cyclo*propane are discussed, and it is shown that the observed numbers of Raman frequencies are not inconsistent with the structures D_{3d} and C_{2v} respectively. In addition, Raman and infra-red data are included for the isomers 1-methyl*cyclo*butene and methylene*cyclo*butane. Tentative assignments of the fundamentals are made for each of the four hydrocarbons. D. F. J.

Analysis and Testing.

322. Alkylbenzenes in the C_9 Fraction from Seven Representative Crude Petroleums. A. F. Forziati and F. D. Rossini. *Bur. Stand. J. Res., Wash.*, Nov. 1947, **39** (5), 425.—This report presents the results of an analysis, by analytical distillation by the A.P.I. Research Project 6 and by spectrographic examination by the Socony-Vacuum Laboratories, Standard Oil Development Co., and Sun Oil Co., of the individual C_9 alkylbenzenes (except 1 : 2 : 3-trimethylbenzene) and of tertbutylbenzene occurring in the C_9 fraction from the following seven representative crudes: (*a*) Ponca, Okla; (*b*) East Texas; (*c*) Bradford, Pa; (*d*) Greenlade–Kawkawlin, Mich.; (*e*) Winkler, Tex; (*f*) Midway, Calif; (*g*) Conroe, Tex.

The results are summarized in tables, and indicate that the alkylbenzenes in the C_9 fraction of petroleum are present in relative amounts that are of the same magnitude for different crude petroleums with the exception that in the Winkler, Tex., naphtha, the 1-methyl-3-ethylbenzene and the 1-methyl-4-ethylbenzene are reversed from the usual orders. G. A. C.

323. Combustion Studies by Means of the Electrical Conductivity of Flames. R. Vichnievsky. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 345–354.—In addition to being more sensitive than the bouncing pin an electronic indicator measuring ionization current can show pre-ignition. Ionization studies were made with transient flames in bombs, the latter were cylindrical in shape, after preliminary trials had shown the unsuitability of spherical bombs. The equivalent resistances for four mixtures, air–H_2, air–C_2H_2, O_2–H_2, and O_2–C_2H_2 were determined and found to be in the inverse order to the theoretical combustion temperature. Tests in an experimental engine showed that equivalent resistances are roughly equal in the case of various liquid, fuels but are markedly more for coal gas. In studies on stationary flames it was found that the maximum intensity of ionization current occurred in an oxidizing flame. In all cases the current intensity varies with mixture richness, it is also greater when the test electrode is made positive. It is concluded that the electrical conductivity of flames is a suitable test method for determining ignition delay, knock intensity, and duration of flame travel. A bibliography of 27 references, dealing with the electrical properties of flames, is appended. (See also Abstract No. 182 (1948).) V. B.

324. Engine Testing of Fuels and Lubricants. 4. Lubricants (Part 2). P. H. Moore. *Petroleum*, Aug. 1947, **10**, 182.—Details of engine testing based mainly on C.R.C. tests are given. Tests for the fuel, and the used and unused lubricant are listed.

Engine-operating conditions and examination after testing are discussed. Consideration is also given to wear determinations and upper-cylinder lubrication. F. W. H. M.

325. Preliminary Note Regarding the Use of the Electron Microscope for the Study of Catalysts, Bleaching Earths, Bentonites, and Shales. F. Alais, P. de Fouchécour, and T. Reis. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 337–340.—Following a description of the technique used in mounting the samples on collodion films 100 Å thick, 7 photographs showing results so far obtained are reproduced. Bentonite particles exhibit a flat shape, the crystalline form of "Tonsil" bleaching earth is in agreement with that found by X-ray diffraction studies and examination of new and spent catalyst indicates a much greater contact surface for the former. V. B.

326. Some Examples of the Application of Infra-red Spectroscopy. R. Martin. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 323–336.—A brief review, with examples mostly drawn

from published material. After mentioning qualitative analysis, illustrated by the detection of dimethyl ether in methyl chloride, the use of infra-red absorption spectra in quantitative determinations is demonstrated by giving the data for the absorptions of the cresols (in *cyclo*hexane solution), with examples of results obtained with commercial samples. The analysis of a six-membered C_4 mixture (*n*-butane, *iso*butane, butene, *iso*butene, *trans*-2-butene, and *cis*-2-butene) is considered in some detail. Infra-red spectroscopy can also be of value in the study of polymerization rates (*e.g.*, polyvinyl chloride and styrene) and of molecular structure (*e.g.*, deutero-substituted methanols). The use of infra-red spectra in the calculation of thermodynamic data is illustrated by constants determined for methyl chloride and tri-deutero-substituted methyl chloride. V. B.

327. Infra-Red Spectra of Hydrocarbons. II. Analysis of Octane Mixtures by the Use of Infra-Red Spectra at Low Temperatures. W. H. Avery and J. R. Morrison. *J. appl. Phys.*, 1947, **18**, 960–967.—The spectrometer used has been previously described, but the optical arrangement and the absorption-cell mounting for low-temperature measurements have been revised. The spectra were observed by condensation of a film of hydrocarbon, the thickness of which could be accurately reproduced, on the reflecting bottom surface of a vertical cell with its lower end immersed in ice (0° C) or liquid nitrogen (− 195° C). Spectra in the region 2–22 microns were obtained for the four trimethyl pentanes, the band widths at − 195° C being approximately one-half as great as at 0° C.

An expression is derived which gives the probability that for each component of a mixture, at least one band can be found which does not "overlap" bands of the other components. The reduction in the band width due to the temperature change from 0 to −195° C increases greatly the calculated probability of the existence of a "non-overlapping" band.

Analysis might be further simplified by using liquid hydrogen or helium as cooling agent. D. F. J.

328. Viscosity Index of Lubricating Oils as a Function of the Engler Viscosities at 50 and 100° C. J. Groff and R. Le Bras. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 341–344.—Graphs are given enabling the V.I. to be obtained from the Engler viscosity at 50 and 100° C in the range 1–40 and 1–6° E respectively. The charts and calculations are based on A.S.T.M. methods. V. B.

329. Initial Oscillation on a Rotational Viscometer. R. N. Weltmann. *J. appl. Phys.*, 1947, **18**, 933–940.—The instrument used was designed to make possible a study of the change in structure of liquids during the initial stages of agitation. The bob of the viscometer was suspended on a helical spring, a deflection being produced by rotation of the cup. To enable the equilibrium position of the bob to be reached as quickly as possible, the oscillating system should be critically damped, or since this condition is not easily obtained in practice, slightly overdamped. That is, $I < \frac{\pi\mu^2}{720\,KS^3}$. I = inertia of the system in gm/cm.², μ = viscosity in poises, K = torsion constant of spring in dynes/cm determined per degree deflection, S = end-effect constant.

D. F. J.

330. End Effect in Rotational Viscometers. C. H. Lindsley and E. K. Fischer. *J. appl. Phys.*, 1947, **18**, 988–996.—In rotational viscometers of practical dimensions the end effect is compensated for by either changing the design or by determining the magnitude of the effect and accounting for it in increased bob length.

A commercial Stormer viscometer with multiple bobs was used to study the variation of the end effect with the following factors: (1) radius of bob; (2) clearance between the cylindrical surfaces; (3) separation between the bottom of the bob and the cup; (4) viscosity.

The magnitude of the end effect increases with the radius and the clearance. For separations at the bottom greater than 1 cm and for viscosities above 1 poise the end effect is nearly constant for each cup-and-bob combination. For lower viscosities the correction must be determined either by calibration with a standard liquid of about the same viscosity as the unknown or by the multiple bob method.

A layer of air trapped beneath the bob, or a bob with an open bottom is almost ineffective in reducing end effect.

Using the method of multiple bobs, data with an accuracy of ± 2% can be obtained without calibration. When the instrument constant is determined with standard liquids or computed from a value of the end effect previously found, the data should be accurate to within ± 0·5%. D. F. J.

331. Patents on Analysis and Testing. Fullers Earth Union, Ltd., and L. N. Preston. B.P. 593,343, 29.10.47. Apparatus for testing liquids.

W. J. Podbielniak. B.P. 594,071, 12.11.47. Apparatus for analysing mixed hydrocarbon fluids.

Anglo-Iranian Oil Co., Ltd., and J. A. McCash. B.P. 596,600, 21.1.48. Sampling devices. G. R. N.

Gas.

332. L.P.G. Sales Gain 30%. R. W. Thomas and K. W. Rugh. *Oil Gas J.*, 1.1.48, **46** (35), 36.—A survey of the liquified-petroleum-gas industry is given. This shows that sales of L.P.G. have more than doubled in the last 3 years, and demand still exists. 20% of all homes using gas are now served with L.P.G., and retail prices are rising due to higher costs. The export of L.P.G., at present small, is growing rapidly, and, while large supplies of propane are available, cost of recovery plants may be increased as much as threefold. G. A. C.

333. Natural Gasoline Looks Ahead. G. G. Oberfell and R. C. Alden. *Petrol. Process.*, June 1947, **2** (6), 453–461.—An economic survey shows that in 1946 distillate and natural-gasoline production in the U.S.A. constituted 11·6% of the motor fuel supply, compared with 7·5% in 1918. Important attributes of natural gasoline are: (1) its high volatility; (2) its high octane number; (3) its low sales price.

The effect of catalytic cracking of crude oil is to lower the volatility of the gasolines produced, but other factors influence the trend towards increased volatility of average motor fuel. The high volatility of natural gasoline is therefore likely to bring it into a favourable position in the market.

If high-octane, high-vapour-pressure natural gasolines can be utilized directly in specialized equipment, a joint enterprise for the automotive, refining, and natural gasoline industries can be envisaged in the development of high-compression truck and bus engines and transport, storage, and marketing of natural gasoline motor fuel. It is possible also that modern processes for the conversion and treatment of light hydrocarbons in straight refining can be applied by natural gasoline manufacturers to increase the volume and scope of their motor fuel operations.

The article is illustrated by ten graphs. W. M. H.

Engine Fuels.

334. Burning Boiler Fuels in Marine Diesel Engines. J. Lamb. *Motor Ship*, Jan. 1948, **28** (415), 336.—The author discusses the economics of the use of boiler fuels in comparison with diesel fuels. On a price-per-ton basis the cost of an average boiler fuel is some 25% less than the diesel. The mechanical methods of separation of the objectionable matter found in boiler fuels are described and a line diagram shows the relation of the main parts of the fuel system in the vessel "Auricula." In general, it is claimed that a heavy fuel, treated in the manner described, is no more harmful to the vital parts of a diesel engine than is diesel fuel. The greater viscosity is overcome by increasing the degree of atomization. I. G. B.

335. Patents on Engine Fuels. J. C. Arnold. (Standard Oil Dev. Co.). B.P. 594,879, 3.12.47. Motor fuels.

Kodak, Ltd. B.P. 595,916, 7.1.48. Motor fuels. G. R. N.

Gas Oil and Fuel Oil.

336. Burning Index for Distillate Fuels. J. C. Reid and A. B. Hersbergen. *A.S.T.M. Bull.*, Mar. 1947, **145**, 77–80.—The relative burning quality of oils has been determined by comparison of burner-operating conditions under which an oil will burn satis-

factorily, giving less smoke than a standard amount. Tests carried out using a rotary wall-flame burner in conjunction with a medium-size boiler with a draught rating of 0·025 in of water resulted in the evolution of a burning index for each oil from its A.P.I. gravity and 50% b.p. A nomograph is given indicating the burning index from gravity in degrees A.P.I. and 50% b.p. in ° F. Burning indexes for blends can be calculated in proportion where the values for the ingredients are known. J. G. H.

Lubricants.

337. Patents on Lubricants. American Cyanamid Co. B.P. 592,164, 24.9.47. Preparation of bis-(2 : 4-dialkylphenol)-4-alkyl phenol sulphides as additives for lubricating oils.

Standard Oil Dev. Co. B.P. 592,214, 24.9.47. Hydraulic fluids.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 592,924, 15.10.47. Prevention of oxidation in oils and the manufacture of aryl sulphides.

C. Arnold (Standard Oil Dev. Co.). B.P. 593,257, 22.10.47. Lubricating oil or grease compositions.

C. C. Wakefield & Co., Ltd., and R. G. E. Clark. B.P. 593,664, 22.10.47. Lubricating devices.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,738, 5.11.47. Prevention of oxidation in hydrocarbon oils.

Standard Oil Dev. Co., and C. Arnold. B.P. 594,936, 3.12.47. Lubricating oil composition for metal drawing, die forging, and like operations.

Shell Dev. Co. B.P. 594,960, 3.12.47. Compounded lubricating oil.

Wakefield & Co., Ltd., E. A. Evans, and J. S. Elliott. B.P. 596,150. 14.1.48. Manufacture of aryl-sulphide additives for mineral oil compositions.

American Cyanamid Co., and H. A. Stevens. B.P. 596,570, 21.1.48. Lubricating oil compositions.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 596,857, 28.1.48. Lubricating oils.

B. H. Lincoln and G. D. Byrkit, assrs to Continental Oil Co. U.S.P. 2,413,718, 7.1.47. An oil-soluble halogenated ester containing at least one carbon–boron bond is used as a lubricating oil additive.

W. R. Turner, assr to Atlantic Refining Co. U.S.P. 2,413,852, 7.1.47. The reaction product of an alkyl-acid phosphate and a branched-chain alkylamine is used as a rust inhibitor in a lubricant.

R. D. Herloeker, M. P. Kleinholz, and F. M. Watkins, assrs to Sinclair Refining Co. U.S.P. 2,413,972, 7.1.47. Tris(morpholinomethyl)phenol is used to improve the rust-inhibiting properties of a turbine oil. G. R. N.

Bitumen, Asphalt, and Tar.

338. Ten Years' Outdoor Exposure of Filled Asphalt Coatings on Saturated Felts. G. L. Oliensis. *A.S.T.M. Bull.*, Jan. 1947, **144**, 32–48.—Previous tests of filled asphalt coatings made on small aluminium panels, usually exposed in the Weatherometer for short periods, indicated that nearly all fillers improve the weatherability of asphalt in varying degrees.

Ten years' exposure tests, outdoors, of coatings on asphalt-saturated felt indicate that, while such fillers as finely ground dolomite, limestone, and oyster shell stabilize the flow and prolong the life of roofing coatings of relatively low softening points which have a tendency to flow or sag when unfilled, they do not improve the crack resistance of coatings with higher softening points which do not flow when unfilled.

J. G. H.

339. An Example of Wax Formation from Asphalt. M. Louis and A. Roubelat. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 355–356.—Examination of a natural asphalt from Gard showed it to consist of asphaltenes 31%, oil 61%, and resins 8%. Cooling of a solution

of the oil in pyridine to − 10° C failed to show wax, but on distilling the three components individually, to 420° C in the presence of superheated steam, the distillates from the asphaltenes, oil, and resin gave 7·5, 1·3, and 1·7% of wax respectively. The wax obtained had 0·9% sulphur. V. B.

340. Patents on Asphalt and Bitumen. Steel Bros. and Co., Ltd., and R. J. Venis. B.P. 593,803, 5.11.47. Preparation of oxidized asphalts from petroleum and/or coal-tar residues.

C. Arnold (Standard Oil Dev. Co.). B.P. 594,455, 26.11.47. Bituminous compositions. G. R. N.

Special Hydrocarbon Products.

341. Electrical Conductivity—Problems of Insulation in Transformer and Cable Oils. A. H. Stuart. *Petroleum*, Aug. 1947, **10**, 174.—Conductivity is discussed with special reference to electrolytes and carboxylic acids. Carboxylic acids arising from the oxidation of hydrocarbons are often sufficiently water soluble to destroy the insulating properties of a good insulator when moisture is present.

Transformer and switch-gear oils are used at elevated temperatures and cool by circulation. These conditions encourage oxidation and increase the very low initial acidity.

Insulating materials, including petroleum oils, show a fall in resistivity with rise of temperature which is often considerable. This is probably due to the influence of moisture and heat on the insulating material. Data are presented showing the effect of temperature on the resistivity of various substances including a high-tension cable oil. The use of cable oils is also discussed.

The value of the dielectric strength of an oil is very sensitive to the presence of traces of water. A graph showing the effect of 0 to 0·10% by vol. of water on the breakdown voltage of a transformer oil is of interest.

Both the specific inductive capacity and the power factor of a mineral oil tend to rise with increase of temperature. F. W. H. M.

342. Fungus—Proofing Automotive Cork Gaskets. S. Bird. *A.S.T.M. Bull.*, Mar. 1947, **145**, 73–76.—Resin- and protein-bonded automotive cork gaskets, untreated and treated with 16 fungicides, were subject to fungus-screening tests using 3 species as test organisms.

Results of mould tests on the gaskets showed that untreated resin-bonded cork is far less subject to mildew growth than untreated protein-bonded cork, and that of the fungicides tested 2% *p*-nitrophenol in *iso*propyl alcohol and fuel oil is the most efficacious treatment for mildew-proofing both types of bonded cork. J. G. H.

343. Oil Deterioration in Transformers and Switch-gear. H. Hurworth. *Engineer*, 1947, **184**, 608–609.—Inspection of nearly 2000 transformer and switch-gear units had shown that sludge was not deposited above the oil level unless the oil vapour was subjected to electrical stress. Tests were carried out on three samples of the same transformer oil held at 55° C for several months, with a potential of 15,000 V.A.C. applied across a pair of electrodes, in the first cell both immersed, in the second cell both in the air space above the oil, and in the third cell one immersed and one above the surface. Maximum acidity was developed in the second cell. Corrosion of transformer lids was worst and sludge deposition heaviest on those parts exposed to cold air coming from a ventilator. This was due to condensation of water and formic acid. For this and other reasons it was considered that the initial advantages of ventilation in reducing maintenance might later be lost through the formation of excessive amounts of sludge. A. C.

Derived Chemical Products.

344. Shell Succeeds in Producing Acrolein. F. G. Watson. *Chem. Engng*, 1947, **54** (12), 106–107.—Acrolein is being produced in a 20,000-lb/month-capacity plant at Houston, Tex. The process is essentially the pyrolysis (at 970° F and 30 p.s.i.) of diallyl ether, a by-product of allyl alcohol manufacture, followed by batch distillation.

Conversion to acrolein (and propylene) to the extent of 86 mol-% of the ether is achieved. Because of the high reactivity of acrolein, air is excluded from the plant, all vessels are provided with natural gas connexions and transfers are made by pressure rather than pumps. Hydroquinone is introduced into the vapour line between the finishing column and condenser to inhibit oxidation. E. B.

345. Chemicals from Petroleum and Natural Gas. G. Egloff. *Chem. Eng. News*, 1947, **25**, 3634–3637.—See Abstract No. 1872 (1947).

Coal, Shale, and Peat.

346. Patent on Coal. J. C. Arnold (Standard Oil Dev. Co.). B.P. 593,630, 5.11.47. Production of motor fuels from coal. G. R. N.

Miscellaneous Products.

347. Cutting Fluid Makers Profit from Chemical Additives Use. G. G. Pritzker. *Chem. Ind.*, Oct. 1947, **61** (4), 632.—With the advent of mass production came the first intensive study of the real function of cutting oils. It was realized that the ideal cutting fluid would be one which would effectively cool and lubricate the cutting tool with equal efficiency, but this ideal could not be achieved without much investigation.

In the initial stages, cutting fluids would either cool or lubricate, *e.g.*, aqueous solutions of alkali in the first case, and fatty oils in the second. The deficiencies encountered with these early cutting oils resulted in the formulation of blends containing mixtures of fatty and mineral oils doped with sulphur, etc., to increase lubricity and led up to the present day soluble and straight cutting oils.

The soluble cutting and grinding fluids contain mineral oil, rust and oxidation inhibitors, coupling agents, emulsifiers (such as mahogany soaps and water), and give lubrication as well as cooling. Extreme pressure additives may be included if desired. Other types, for special purposes, are based on mixtures of mineral oil and sulphurized, chlorinated, or phosphorized vegetable oils. Anti-foaming additives, of which a large number are known, are generally included in the fluids.

Straight cutting oils are usually supplied with the necessary extreme-pressure properties either by sulphurization or by the addition of materials containing large proportions of sulphur, although it has been reported by many investigators that wear is increased by the use of sulphurized oils. Metallic naphthenates have also been found useful in this respect.

All in all, there is a very large number of cutting fluid formulations on the market and the advances from the early days have been great. There is, however, still room for improvement. O. M.

348. Fog Aerosol Machine to Control Vegetable Insects. G. P. Wene. *J. Econ. Ent.*, Oct. 1947, **40** (5), 675–679.—In 1946 a thermal aerosol fog generator was used successfully against garden fleahoppers and aphids in the Lower Rio Grande valley. The insecticides included D.D.T., pyrethrins, rhothane, and the new hexa-ethyl tetraphosphate, all dissolved in common kerosene. Results indicate that effective distance of the aerosol drift depends partly on the type of insecticide used; a hood to confine the aerosol fog is needed on windy days. The large aerosol particle, 30 microns or more in size, was most effective. The kerosene used as aerosol media was shown not to injure plant foliage. Five literature references are included. W. M. H.

349. Oil-Resisting Rubber. Anon. *Chem. Prod.*, Nov.–Dec., 1947, **11** (1–2), 13.—A memorandum issued by the British Rubber Development Board, London, postulates a semi-quantitative theory of the swelling and solution of rubber with solvents. Mixture of two liquids involves changes in intermolecular forces by bringing unlike molecules together, reflected in the absorption or evolution of heat. From accurate measurements over a range of temperature, of the vapour pressure of the liquid above mixtures of rubber and liquid, the heat of mixing rubber with a liquid can be calculated, and the system rubber plus benzene shows that the entropy of mixing is very large and heat is absorbed. Thus the phenomenon is an increase in entropy brought about by the natural tendency of molecules to mix by thermal motion.

For a given rubber, the solvent or swelling powers of a range of liquids will depend upon their cohesive energy densities relative to that of the rubber.

It is concluded that a rubber cannot be made oil resisting by physical compounding, and resistant chemical structure can be predicted. G. A. C.

350. The Waterproofing of Fibrous Materials. E. E. Halls. *Industr. Chem.*, 1948, **24**, 37–45.—Special reference is made to wax and bitumen treatment for ropes and cordage, methods used depending on service requirements. Oils, waxes, and bitumens are used together with plastics. The process is generally to pass the pre-dried rope rapidly through the dissolved or melted impregnant. Notes are given on the various impregnants; the most commonly used being petroleum bitumens and paraffin waxes, both graded according to m.p. High m.p. micro-crystalline waxes are in demand for certain types of cordage. Desired properties in an impregnant are frequently obtained by blending. Emulsions are used in cold processes and several published formulæ and recipes of emulsions containing bitumens and waxes are given. E. B.

351. Patents on Miscellaneous Products. Shell Dev. Co. B.P. 592,604, 8.10.47. Production of copolymers of unsaturated esters of ethereal oxygen-containing acids.

Standard Oil Dev. Co. B.P. 592,838, 15.10.47. Manufacture of unsaturated esters.

Visking Corpn. B.P. 593,109, 22.10.47. Preparation of nitro-olefins.

T. B. Butson. B.P. 593,421, 29.10.47. Manufacture of fuel briquettes.

J. C. Arnold (Standard Oil Dev. Co.). B.P. 594,036, 12.11.47. Surface coating and impregnating composition.

C. Weizmann. B.P. 594,182, 19.11.47. Condensation products from substances containing reactive methylene groups.

Rohm & Haas Co. B.P. 594,475–9, 26.11.47. Polymeric detergents.

Anglo-Iranian Oil Co., Ltd., E. W. M. Fawcett, and A. Millien. B.P. 594,818, 3.12.47. Olefin-polysulphide compositions.

Shell Dev. Co. B.P. 595,197, 10.12.47. Recovery of molybdenum, tungsten, and uranium.

Shell Dev. Co. B.P. 595,502, 17.12.47. Preparation of polyallyl and like alcohols.

Shell Dev. Co. B.P. 595,758, 2.1.48. Production of resins.

C. Arnold (Standard Oil Dev. Co.). B.P. 596,287, 14.1.48. Production of aromatic amines.

Shell Dev. Co. B.P. 596,668, 21.1.48. Production of di-alkenyl silicones.

B. P. Geyer and S. A. Bullard, assrs to Shell Dev. Co. U.S.P. 2,413,822, 7.1.47. Production of diacetone alcohol methyl ether from methanol and mesityl oxide.

F. P. Otto, assr to Socony Vacuum Oil Co. U.S.P. 2,414,057, 7.1.47. Preparation of halo-sulphurized cardanol ethers. G. R. N.

Engines and Automotive Equipment.

352. A Study of Piston-Ring Reasoning and Design. Part I. Anon. *Diesel Pwr. Diesel Transportation*, Oct. 1947, **25** (10), 52.—To establish basic data relating to the compression-ring design of diesel pistons, a series of tests were carried out on a four-stroke, single-cylinder engine. Five different cylinder liners were used, four of them being machined to varying degrees of taper to simulate the shape of a worn liner. The piston held three compression rings and one oil-control ring; in addition, a second oil-control ring was fitted for the tests with the large taper liners in order to stabilize oil consumption.

An investigation of the relationship between compression-ring design and blow-by, fuel economy and maximum power output led to the following conclusions: (1) when plain compression rings were used in tapered or worn cylinders, blow-by increased rapidly with increase in cylinder wear, owing to increased ring-gap clearance; (2) within the limits of test, the replacement of plain compression rings with two-piece sealing

rings resulted in a lower and more consistent amount of blow-by, regardless of the degree of cylinder taper; (3) the reduction in blow-by by the use of sealing rings led to an appreciable improvement in fuel economy, since specific fuel consumption increased with increased blow-by; (4) when sealing rings were used, the maximum power output remained the same regardless of cylinder taper; with plain rings and a worn cylinder, the maximum power was considerably less than when sealing rings were used. C. D. B.

353. Patents on Engines and Automotive Equipment. Shell Dev. Co. B.P. 592,966, 15.10.47. Fuelling of I.C. engines.

Anglo-Saxon Petroleum Co., Ltd., and R. Hargreaves. B.P. 594,418, 26.11.47. Treatment of engine valves.

Texaco Development Corpn. B.P. 596,846, 28.1.48. Modified Otto cycle I.C. engines. G. R. N.

MISCELLANEOUS.

354. Survey of World Oil Refineries. Anon. *Oil Gas J.*, 27.12.47, **46** (34), 200.—The survey gives location, crude capacity, type, and cracking capacity of foreign refineries (excluding U.S. and U.S.S.R.). The total number of such refineries is given as 238, having a combined crude capacity of nearly 3 million brl daily, with 1 million brl daily cracking capacity. G. A. C.

355. Polish Oil Industry. F. Wirth. *Pétróleum*, Aug. 1947, **10**, 176.—The production from the Polish oilfields in 1946 amounted to 116,742 metric tons, an increase of 12·14% on the 1945 output. Statistical details of this production are given. Pumping developments include the introduction of the "plunger" pumps and variants of this type of pump. Equipment renewal problems are also discussed.

During 1946 the production of natural gas was 150,599,000 cu. m. F. W. H. M.

356. Miscellaneous Patents. J. C. Arnold (Standard Oil Dev. Co.). B.P. 592,857, 15.10.47. Prevention of corrosion of metal surfaces.

Anglo-Iranian Oil Co., Ltd., and E. E. Mills. B.P. 595,209, 10.12.47. Safety devices for preventing over-luffing in jib cranes. G. R. N.

BOOKS RECEIVED.

La Viscosité des Mélanges de "Fluides Normaux." M. Roegiers and L. Roegiers. Ghent (Belgium), 1947. Société des Huiles De Cavel & Roegiers, S.A. 47 pp. n.p.

A brief mathematical study of the viscosities of liquid mixtures. An equation is derived to express the viscosity of binary oil mixtures. This equation is used to construct a graphical scale for the calculation of the viscosity of mixtures and the use of this scale is described in some detail. An abstract in English, at some length, is included. V. B.

Proceedings 26th Annual Meeting A.P.I. Sect. III.—Refining; Sect. IV.—Production. New York: American Petroleum Institute, 1946. Pp. 305 and 367. 50c. each.

In the refining section eleven papers form a symposium on high-temperature analytical distillation, while eight are devoted to gasoline. Two other papers discuss spectroscopic analysis and hydrocarbon synthesis respectively.

The sub-divisions of the production section are group sessions on production (summaries of papers), symposium on secondary recovery (ten papers), 1946 supplement to bibliography on secondary recovery, standing-committee reports, and standardization committee reports.

S.I.M.A. Handbook, 1947. London: Scientific Instrument Manufacturers' Association of Great Britain Ltd., 1947. Pp. 219. 10*s.* 6*d.* post free.

The main feature of this 220-page book is an alphabetical index (containing about 2000 entries) of the products made by the members of the Association, supplemented by a list of these firms with their products. By using these lists, it is easy to discover in a few moments the names and addresses of the makers of almost any type of scientific instrument, as well as the products of any particular firm.

The Handbook, which is nearly double the size of the previous edition, contains also full information about the Association, illustrated reviews of the British scientific instrument industry and its work, an eight-page list of research organizations, and other such useful matter.

Transactions of the Institution of Chemical Engineers, Vol. 22, 1944. London, Institution of Chemical Engineers. Pp. 160 + xvii.

Among the papers in this volume is one on "Infra-red Radiation and its Relation to Distillation and Evaporation Problems," by J. Arthur Reavell.

Transactions of the Institute of Marine Engineers, Vol. LVIII, 1946–7. London: Institute of Marine Engineers, 1947. Pp. 253 + xl.

Papers in this volume include "Oil Engine Dynamics with Special Reference to the Opposed-piston Engine" (W. Ker Wilson); "The Lubrication of Steam Turbines" (S. J. M. Auld); and "The History of the Opposed-piston Marine Oil Engine" (W. Ker Wilson).

Platts' Oil Price Handbook for 1946. Cleveland, Ohio: Platt's Price Service Inc., 1947. Pp. 388. $12.50.

Detailed information regarding U.S. refinery and seaboard prices of refined oil products, tank wagon, and dealer prices of gasolines and kerosine, and crude oil prices.

Glossary of the Petroleum Industry. Oscar B. Irizany. Tulsa, Okla: Petroleum Publishing Co., 1947. Pp. 316 + ix.

Contains over 12,000 technical and other terms used in the petroleum industry with their English–Spanish and Spanish–English equivalents.

Principles of Industrial Process Control. Donald P. Eckman. London: Chapman & Hall Ltd.; New York: John Wiley & Sons Inc., 1945. Pp. 237 + x.

An introduction to the science of automatic control. The laws of operation of industrial automatic control systems are treated in a logical manner.

Oil and Gas Production Data, Eddy Co., New Mexico, 1943–5. N. Raymond Lamb and W. B. Macey. Socorro: New Mexico Bureau of Mines & Mineral Resources, 1947. Pp. 146.

A statistical summary of oil and gas production in Eddy County, New Mexico, for the years 1943, 1944, and 1945.

1945 Reference Report on Certain Oil and Gas Fields of North Louisiana, South Arkansas, Mississippi, and Alabama. 2 vols. Shreveport, La: Shreveport Geological Society, 1947. Pp. 503. Pl. 12. Vol. I, $12.50; Vol. II, $10.00.

Maps and statistical data on eighty-five fields in the area covered. Twelve stratigraphic sections are given and Vol. II includes papers on "Notes on Correlations of the Cretaceous of East Texas, South Arkansas, North Louisiana, Mississippi, and Alabama," and "Notes on Stratigraphy of the Formations which Underlie the Smackover Limestone in South Arkansas, Northeast Texas, and North Louisiana," both by Roy T. Haggard, B. W. Blanpied, and W. C. Spooner.

German Intelligence Reports.

B.I.O.S.

1669. The Use of Dismulgans for Breaking Crude and Naval Fuel-Oil Emulsions. Pp. 19.

Miscellaneous 60. The Synthesis of Hydrocarbons and Chemicals from CO and H_2. Pp. 128.

F.I.A.T.

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Oilfield Exploration and Exploitation.

Geology.

357. Geomorphology of Depositional Surfaces. W. A. Price. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1784–1800.—The geomorphology of depositional surfaces has been slow in developing. Adequate study of the subject requires topographic maps of finer detail than have commonly been available until recent years, and is much assisted by aerial photographs, soil maps, maps of vegetational distribution, and by studies of the materials of the geomorphic units mapped.

Recognition of regional patterns and topographic grain of depositional origins is an important part of the study.

The systematic study of depositional surfaces adds much to the knowledge of geomorphology and late geologic history. It throws light on climatology, soil science, archæology, and palæontology. E. N. T.

358. Microbial Transformation of Molecular Hydrogen in Marine Sediments, with Particular Reference to Petroleum. C. E. Zobell. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1709–1751.—Molecular hydrogen is produced by a large number of bacterial species, many of which occur in marine sediments. Up to 10,000 hydrogen-producing bacteria were found per gramme of mud on the floor of the Pacific Ocean. Cultures of such bacteria have been shown to liberate hydrogen from organic compounds at temperatures ranging from 0° to 65° C. Hydrogen is liberated from many organic compounds, and most readily from carbohydrates or poly-hydroxy alcohols. Redox potentials more reducing than E_h – 0·05 volt and reactions ranging from pH 5·5 to 9·8 favour hydrogen formation.

The rapid consumption of hydrogen by samples of soil and sediments is attributed to the activities of bacteria or their enzymes which catalyse its oxidation. Of greater geological importance are various kinds of anærobes which oxidize hydrogen with the formation of methane, simple organic acids, ammonia, and hydrogen sulphide. Bacteria produce methane by catalysing the reduction of carbon dioxide or other one-carbon-atom compounds with hydrogen. Other bacteria catalyse the reduction of carbon dioxide by hydrogen with the formation of formic, acetic, and possibly other carboxylic acids. Amino acids and other organic compounds are also reduced by hydrogen-activating bacteria. Certain bacteria found in sediments utilize energy from the oxidation of molecular hydrogen for the reduction of sulphate while others reduce nitrate and nitrite.

It is suggested that hydrogen-oxidizing bacteria, in conjunction with radioactivity and other catalytic agents in sediments, may contribute to the formation of petroleum hydrocarbons. E. N. T.

359. Stratigraphic Convergence Problems in Oil-Finding. R. M. Swesnik and R. R. Wheeler. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 2021–2029.—Onlap, involving loss of beds at the base of a transgressing sequence, and truncation, by which beds are bevelled off by different erosion, are the important factors in stratigraphic convergence. These processes are quantitatively discussed with reference to the rate of dip of the upper beds, the unconformity, and the lower beds. The applications of convergence formulæ to reconstructing palæogeology, to locate belts of wedge-out reservoir rocks, and to detecting structural anomalies are discussed. E. N. T.

360. World Proven Crude-oil Reserves nearly 70,000,000,000 brl. Anon. *Oil Gas J.*, 27.12.47, **36** (34), 268.—The leading crude oil reserves figures are estimated as follows: U.S.A. (21,345,000,000 brl), Iran (9,500,000,000 brl), Venezuela (8,500,000,000 brl), Iraq (7,500,000,000 brl), Saudi Arabia (6,000,000,000 brl), U.S.S.R. (6,000,000,000 brl), Kuwait (5,000,000,000 brl), and Mexico (1,200,000,000 brl). The world total is 68,820,000,000 brl.

A table gives figures for other countries. G. D. H.

361. Exploration Mark Set in 11 Months. Anon. *World Oil*, Jan. 1948, **127** (9), 56.—5019 exploratory wells had been completed in the U.S.A. in 1947 at the end of

November. The November figure was 504, of which 92 produced. Tables summarize the results of the exploratory drilling in November, and the discoveries are listed with brief notes. G. D. H.

362. Discoveries : Exploration Campaign Stepped-up to Highest Level in History. L. S. McCaslin. *Oil Gas J.*, 29.1.48, **46** (39), 162.—5461 exploratory wells (864 oil and 248 gas) were completed in 1947. The greatest addition to reserves in the form of new fields was in Oklahoma, followed in descending order by Kansas, Texas, Illinois, Wyoming, Montana, and California. Texas had 1460 wildcats and Oklahoma 693.

In West Texas, production was found east of the Central Platform. Oil was obtained 12 miles off shore from Louisiana at 1734–1750 ft.

Diagrams show the numbers of wildcats drilled and the results for leading States. G. D. H.

363. Diagenesis of Oil-Field Brines. L. U. De Sitter. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 2030–2040.—Analyses of oilfield waters of the U.S.A. are assembled in diagrams, and it is deduced that in the development of connate water from sea water, two distinct diagenetic phases must be recognized. The first phase is the precipitation of magnesium, calcium, sulphate, and carbonate, the second phase is a concentration with a gradual increase of magnesium and calcium ions. The first phase is due to base exchange with the clay sediment, and the second phase to the semi-permeable property of the shales during the later stages of compaction. E. N. T.

364. Deep Basins of the United States, Drilling the Deep Areas. D. Hager. *Oil Gas J.*, **46** (36), 64.—The results of deeper drilling in recent years have exploded the old ideas that porosity and permeability would be too low for oil production below 8000 ft, and that only the margins of basins would be worthy of attention.

Deep drilling is expensive. There are oil possibilities in a few places such as Ventura Avenue at 18,000–20,000 ft. Parts of the San Joaquin Valley also may have deep production. The maximum depths of the Uinta and Denver basins in Colorado may be 20,000 ft, and much the same may be true of the Big Horn and Powder River basins of Wyoming. The Green River basin may have deeps of 40,000 ft. The Lemmon–Williston basin has sediments 14,000–15,000 ft thick. The basement beds of the Michigan Basin may be at 13,000–14,000 ft, whereas the Appalachian basin may have 30,000 ft of sediments. In the latter case, depths of 20,000 ft may be of interest.

In all the deep basins of the U.S.A., not over 10,000,000 acres have over 20,000 ft of sediments, and on the assumption that 1% of this area might be productive this would be but 2–3% of the productive acreage of the U.S.A.

If the deeper drilling is hard a 20,000-ft well may cost 1½–2 million dollars.

The main deep areas of the U.S.A. are listed, with an estimate of the maximum thickness of sediments present, and an indication of their chances of yielding commercial oil production in the deepest parts. G. D. H.

365. Origin and Migration of Oil into Sespe Redbeds, Calif. T. L. Bailey. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1913–1935.—The name " Sespe formation " is applied to the non-marine redbed facies of a group of sedimentary rocks up to 7500 ft thick that range in age from Upper Eocene into Lower Miocene in the southern and eastern parts of the Ventura basin, California, but are probably restricted to the Oligocene in most of the northern and western part of the basin.

The bulk of the evidence suggests that the larger part of the oil content was derived from Eocene shales. Vertical migration across the bedding of several hundred to a few thousand ft of predominantly sandy strata seems to be required. Countless minor joints and cracks are suggested as the principal channels of vertical migration. E. N. T.

366. Black Warrior Basin, Alabama and Mississippi. F. F. Mellen. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1801–1816.—A triangular area of approximately 35,000 sq. miles of Palæozoic sediments occupies a large part of Northern Mississippi and Northwestern Alabama. The Black Warrior Basin is bounded on the east by the southwesterly plunging Appalachian folds; on the south and southwest by the southeasterly plunging Ouachita mountain system; and on the north by the high Ordovician

areas of Tennessee. Several hundred test wells have penetrated Palæozoic sedimentary rocks ranging in age from Cambro–Ordovician to Pennsylvanian. The total thickness of sedimentary rocks penetrated by these wells is about 12,000 ft. No igneous or metamorphic rocks have been found in the basin, with one doubtful exception.

In the Ouachita boundary area south and southwest of the basin, basaltic intrusions, probably Mesozoic in age, are common in metamorphosed Palæozoic sediments. Commercial gas production from Silurian, Mississippian, and Pennsylvanian rocks has so far been insignificant; but the numerous shows combined with sharp unconformities, lithological changes, faults, and anticlinal structures, make Black Warrior Basin one of the large remaining undeveloped potential oil-producing provinces of North America.

E. N. T.

367. Pennsylvanian Stratigraphy of Colorado Springs Quadrangle, Colorado. K. P. McLaughlin. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1936–1981.—Detailed study of two Pennsylvanian formations, the Glen Eyrie and the Fountain, along the east flank of the Colorado Front Range, indicates that such investigations are fundamental to an understanding of redbed stratigraphy.

The Glen Eyrie and Fountain formations in the vicinity of the Manitou embayment were deposited in a deltaic environment during mid-Pennsylvanian time, being derived from a highland whose eastern margin closely coincided with that of the present Front Range.

The strata contain a varied fauna which indicate that the two formations are of a Marmaton or later age as recognized in the Mid-Continent Pennsylvanian section.

Detailed descriptions of the type sections of Glen Eyrie and Fountain formations are presented for the first time. Maps showing the distribution of the two formations within the Colorado Springs Quadrangle and the extent of thin limestone beds within the Fountain of the southwestern quarter of the quadrangle are included. The Glen Eyrie has been raised from its former status as a member of the Fountain to the rank of formation.

Subsurface data reveals that, for a distance of 18 miles at least, the Fountain thickens eastward at a rate of approximately 100 ft/mile. Well samples indicate no marked lithologic change in the Fountain through this distance. E. N. T.

368. Geology and Occurrence of Oil in Florida. E. D. Pressler. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1851–1862.—The eastern part of the Gulf of Mexico Basin can be subdivided on the basis of its major structural features. The southeast-striking ridge formed by the Central Georgia, Ocala, and Bahama uplifts represents the marginal flexure of this part of the Gulf Basin. The Apalachicola embayment of South Georgia and West Florida has a maximum thickness of 15,000 ft of clastic sediments, and the South Florida embayment, which covers the area of South Florida, the Bahamas, Cuba, and the intervening areas, has a maximum of 20,000 ft of non-clastic sediments. The great Bahama Bank is underlain by a section in excess of 10,000 ft. Anticlines are probably the most prevalent type of structure of both embayments, though faulting is undoubtedly present. Oil production has been developed on the South Florida segment of the embayment.

The Sunniland field of Collier County, Florida, has four producing wells that have produced approximately 100,000 brl of 19–24·5° gravity oil. One rig is working in the field, and eight wildcat operations are active in Florida. E. N. T.

369. Cenozoic Deposits of Central Gulf Coast Plain. G. E. Murray. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1825–1850.—At least 20,000 ft of Tertiary and Quaternary strata occur in the Central Gulf Coast region of the U.S.A. They comprise a large geosyncline of thick deltaic and thin marine beds. The Tertiary rocks can be divided into Paleocene, Eocene, Oligocene, Miocene, and (doubtfully) Pliocene, outcropping successively nearer and nearer to the coastline. The Quaternary is represented by Pleistocene and recent epochs of deposition, and beds are characteristically fluviatile gravels, sands, silts, and clays.

Detailed maps and sections are given with isopachous and structural contour maps and representative electrical logs. E. N. T.

370. Stratigraphy of Outcropping Cretaceous Beds of Southern United States from Kentucky to Georgia. W. H. Moore. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1817–1824.—A total thickness of 2100 ft of Cretaceous strata outcrop in the southeastern States of the U.S.A. from Kentucky to Georgia. In ascending order the sequence is: Vick formation, Tuscaloosa group, McShan formation, Eutaw formation, and Selma group. Equivalent Texas formations are traced. E. N. T.

371. Anadarko Basin—Geology and Oil Possibilities. R. R. Wheeler. *World Oil*, Jan. 1948, **127** (9), 100.—In the Anadarko trough the early Pennsylvanian sands are regarded as the most favourable objectives. Only a few scattered deep tests have been drilled, and it is clear that exploration has not been adequate. The Arbuckle has poor porosity and is not viewed favourably. The Simpson affords some chances from the Kansas boundary at about 5500 ft to central Major County at about 8000 ft. Where dolomitic the Viola and Maquoketa are possibilities in the north, and the Viola has tested gas and oil at several places in the south. The wedge-out of the Hunton tends to be dolomitized, but this formation has not been encouraging except at West Edmond.

On the northern shelf and in the Dodge City Embayment, the Mississippian offers sands, oolitic limestones, dolomitic limestones, and local concentrations of residual chert. The Morrow sands may be at least 1000 ft thick, and this formation wedges out beneath the Deese on the flanks of the Arbuckle and Wichita uplifts. Provided the facies is suitable the wedge-out is of great interest from the point of view of oil occurrence. Some production has been obtained from the Deese sand, and the same is true of the more erratic Hoxbar sands.

Fairly prolific gas reservoirs exist in Pontotoc arkoses and dolomites, as at Cement and Hugoton.

Seismic work coupled with subsurface geological studies has proved the most satisfactory exploratory technique.

Subsurface structures frequently differ in position from surface structures, and may have different forms. Stratigraphic traps are likely to be common in the Anadarko basin. Wildcatters have made a number of important and unexpected discoveries.

A series of maps show the prospective oil-bearing areas for different formations.

G. D. H.

372. Physical and Chemical Properties of Ellenburger Rocks, Llando County, Texas. S. S. Goldich and E. B. Parmelee. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1982–2020.—Physical and chemical data are given for 75 samples from a stratigraphic section of the Ellenburger group on Riley Mountain, Llano County, Texas. The division of samples is: limestone, 29; dolomite, 42; mixed rocks, 4; a cherty limestone, a dolomite limestone, and two calcitic dolomite samples. The limestone has a dense to sublithographic texture with pellet and breccia structures as variations.

Samples of the dolomite exhibit a range in texture and are classified in four groups: (1) microgranular and very fine-grained; (2) fine-grained; (3) medium-grained; and (4) coarse-grained. Physical and chemical properties are more variable than those of limestone samples.

Detrital minerals in the insoluble residues from the limestone and dolomite samples are quartz, felspar, leucoxene, magnetite-ilemite, tourmaline, zircon, muscovite, garnet, and apatite. Authigenic minerals include chert, quartz, felspar, clay minerals, glauconite, and pyrite. Chert is the chief constituent of the residues, and varieties are dense or cryptocrystalline, fine to coarsely granular, and fibrous chalcedonic.

In appearance and in bulk composition the limestone samples are remarkably uniform. The dolomitic limestones and the calcitic dolomite samples come from a zone which marks the transition from the dolomitic to the calcitic facies of the Staendebach member of the Tanyard formation. The coarse-grained dolomite is restricted to the lower part of the Tanyard, and the very fine-grained dolomite is limited to the Gorman and Honeycut formations. The residues from the Tanyard formation are characterized by dense chert; whereas the residues from the Gorman and Honeycut contain abundant detrital material, principally quartz and felspar, in addition to chert.

Detailed chemical analyses of the Ellenburger limestone and domolite are given, and a method for determining the approximate composition of samples, based on determinations of grain density and insoluble content, is described. E. N. T.

373. South Texas Giant in Limelight. Anon. *Oil Gas J.*, 27.12.47, **46** (34), 297.—Oil production has been extended about a mile north-northeast on the east flank at Agua Dulce. A drillstem test at 7300–7320 ft found 37° oil. Nearly 50 miles southwest, near La Gloria, a new oil sand was topped at 7270 ft, and it gave 40·2° oil at 145 b.d. Production was also obtained in the Loma Blanca sand at 6525–6542 ft.

The Agua Dulce–La Gloria field gives gas and oil condensate. G. D. H.

374. Benedum Field. G. Weber. *Oil Gas J.*, 5.2.48, **46** (40), 80.—The Benedum field is in the Midland Basin in Upton County, West Texas. It is on an anticlinal structure 10 miles northwest of Big Lake. A well was drilled to 9748 ft in 1941, and was suspended until 1947. Drilling was continued through Devonian chert and Silurian, where cuttings had good shows, into the Ellenburger. Sixteen drillstem tests were attempted, one in the Pennsylvanian at 9410–9494 ft, and the rest in the Ellenburger below 11,030 ft. In most cases gas was present, and in some oil. Casing was set at 12,018 ft, and perforations made at 11,885–11,910 ft, 11,945–11,960 ft, and 11,975–11,985 ft. After swabbing and acidizing the well flowed 53 brl/hr through a 1-in choke. A later test gave 383 b.d. with a G.O.R. of 4000, on ½-in bottom and ¾-in top chokes. The bottom-hole pressure and temperature were respectively 5225 p.s.i. and 200° F. The oil is 56°-gravity, and heavier oil is expected deeper on the structure.

The Mississippian is absent. The Devonian was met at 10,018 ft, Silurian at 10,600 ft, and Ellenburger at 11,020 ft.

Details of the drillstem tests are given, together with Schlumberger and radioactivity logs below 10,000 ft, and a description of the drilling. G. D. H.

375. Pre-Permian Oil in Midland Basin. Anon. *Oil Gas J.*, 8.1.48, **46** (36), 97.—A well in West Texas, 12 miles northeast of Rankin and 9 miles from Big Lake has produced 56° oil at 37 brl/hr, through a ¾-in choke with a G.O.R. of 4000. Production is from the Ellenburger through perforations at 11,885–11,910 ft, 11,945–11,960 ft, and 11,975–11,985 ft. The Ellenburger was penetrated for 1002 ft. The lowest point reached still showed good staining.

The well is east of the Central Platform in the deeper part of the Midland Basin. The flexure is comparatively minor compared with the Central Platform. The Ellenburger is covered by about 1000 ft of pre-Pennsylvanian beds. G. D. H.

376. Exploration in Alaska. K. M. Fagin. *Petrol. Engr*, Sept. 1947, **18** (13), 150.—The methods of geological and geophysical work used in the exploration of North Alaska are reviewed. R. B. S.

377. Alaskan Exploration Makes Steady Progress. Anon. *World Petrol.*, Feb. 1948, **19** (2), 50.—U.S. Naval Reserve No. 4, covering 35,000 sq. miles, was established in 1923, but little was done until 1944. The first test was spudded on the Umiat structure in 1945 and went to 6005 ft.

A second well was spudded last summer, and a core-hole is pumping 15 b.d. of oil from a sand at 572 ft.

Cape Simpson No. 1 has found gas shows in drilling to 6000 ft. This well is near seeps on a small seismograph structure. A test will probably be drilled 75 miles west of Umiat on the large Oumalik structure. G. D. H.

378. Brazil has Extensive Sedimentary Areas Favourable to Accumulation of Petroleum. A. I. de Oliveira. *Oil Gas J.*, 15.1.48, **46** (37), 48.—The Amazon basin is the only area of Brazil offering possibilities of important oil production. It includes an old geosyncline which existed to the end of the Palæozoic, and sediments, mostly marine, of Cambrian, Silurian, Devonian, and Carboniferous age have been recognized. The maximum thickness is 2400 ft. These beds are overlain by Tertiary beds, generally of continental types. Wells along the Tapajoz river have encountered oil and gas shows in the Devonian. Two wells have been drilled in the Acre area on the Cretaceous anticline of the Moa range.

The Maranhao–Piaui basin has Silurian to Permian beds at least 4000 ft at the maximum, and some of them marine. Triassic beds, in part marine, overlie them.

Mesozoic and Tertiary beds occur in the Atlantic coast belt from Ceara to Espiritu Santo. Northward-dipping Cretaceous beds occur in the Rio Grande do Norte coastal

area. In coastal Alagoas are Pliocene continental beds underlain by shale, sandstone, and bituminous conglomerate, possibly of Cretaceous and Pliocene age. Wells have found several oil-bearing horizons.

Marine Cretaceous beds occur in Sergipe. Evidences of oil and gas have been found in wells.

A Mesozoic and Tertiary sedimentary basin exists at the Baia de Todos os Santos in Bahia, and some 11,500 ft of beds are present. Since 1939 about 126 wells have been drilled at Reconcavo, yielding 64 oil wells and 15 gas wells. Reserves of 12,000,000 brl of oil and 1,000,000,000 cu. m of gas have been discovered.

The Parana basin has pre-Cambrian to Cretaceous sediments. The Devonian, Carboniferous, and Permian beds are not metamorphosed, and are overlain by Mesozoic beds. The Devonian to Triassic beds are believed to be of interest with regard to oil. There are asphaltic seepages and bituminous sandstones in the Lower Trias and Carboniferous. Some wells have been drilled and have encountered oil and gas shows. The deepest well was about 5425 ft.

Geological and geophysical work has indicated the presence of 10,000 ft of Tertiary and Palæozoic sediments in the Island of Marajo and its vicinity.

The legal aspect of petroleum development in Brazil is briefly discussed.

G. D. H.

379. El Mene De Acosta Field, Falcon, Venezuela. H. H. Suter. *Bull. Amer. Ass. Petrol Geol.*, 1947, **31**, 2193–2206.—The abandoned El Mene de Acosta field is situated in the State of Falcon, northwest of Puerto Cabello in the Tocuyo Valley.

The structure is an asymmetric northeast-trending anticline of which only the south flank was productive. The accumulation is Oligocene in age and the trap is a combination stratigraphic–structural one.

The discovery well was drilled in 1927, and the field was closed in 1937. Eighty-two wells were drilled.

The producing formation is the Oligocene El Salto member of the San Lorenzo formation, one of the group of Agua Salada formations and 600 ft in thickness.

Approximately 759,070 brl were produced before the field was abandoned.

E. N. T.

380. Oil Fields of Greater Oficina Area, Central Anzoategui, Venezuela. H. D. Hedberg, L. C. Sass, and H. J. Funkhouser. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 2090–2169.—The oilfields of the Greater Oficina area are situated in the interior plains of Venezuela. Since the completion of the discovery well in 1937, 16 fields with a total of 512 wells have been drilled, resulting in a production of more than 127 million brl of oil up to January, 1946.

The region is covered by Quaternary and uppermost Tertiary deposits, and surface indications of structure are meagre. The discovery well was located on the basis of torsion-balance and refraction seismograph work, and subsequent development has been guided mainly by geophysical, structure-drill, and subsurface geological work.

The section encountered by wells in this area is as follows:

Mesa Formation (Pleistocene) 0–500 ft thick;
Sacacual group (Upper Miocene–Pliocene) 400–3000 ft thick;
Freites Formation (Middle Miocene) 1100–2000 ft thick;
Oficina Formation (Oligocene–Miocene) 2000–4000 ft thick;
Temblador Formation (Cretaceous) 500–1500 ft thick (Unconformity);
Basement igneous and metamorphic rocks (Unconformity).

The area is a segment of the southern limb of the East Venezuelan structural basin. Dips are very gentle, and accumulation is controlled largely by normal faults. Stratigraphic pinch-outs are locally important adjuncts to accumulation.

Production is from sands in the Oficina formation, constituting 340 separate, productive reservoirs at depths ranging from 4000 to 7000 ft. Total surface productive area to date amounts to more than 25,000 acres. Net productive sand thicknesses in individual wells may amount to as much as 550 ft.

Reservoir pressures show a regular straight-line increase within the Oficina formation, but are slightly out of equilibrium with hydrostatic pressures in near-surface sands. The temperature gradient is about 51 ft/° F. Oil gravities range from 8° to

57°; the oil being produced averages about 34° A.P.I. Gravities in general are heavier with depth. The Oficina oils are largely of intermediate base. Some reservoirs contain oil with a wax content of 15% by weight. Some reservoirs have gas-caps, but few produce gas only.

It is believed that the oil produced in the fields originated within the Oficina Formation and in close proximity stratigraphically with the reservoirs in which it is now found. There is evidence, however, of some up-dip lateral migration within the reservoir sands.

Well spacing is on the equilateral-triangle system, and varies from 14 to 42 acres or more. The relatively flat, open terrain allows skidding of rigs and derricks from one location to the next. Pressure maintenance and secondary-recovery projects are in prospect. The outlet of the fields is through a 155-km pipeline to the coast at Puerto la Cruz. E. N. T.

381. Oil Fields of West Buchivacoa, Venezuela. G. W. Halse. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 2170–2192.—Attention was directed before 1907 to the oil possibilities of West Buchivacoa by a seepage of light oil at El Mene.

Drilling commenced in 1920 and by 1925 the peak of production was reached. Production still continues, a total of 29 million brl of oil having been obtained.

The structure at El Mene is due to anticlinal folding on a pre-existing eroded axis. The overburden of early Miocene rocks has curbed the folding movement, thus preventing excessive shattering. Farther along the axis, crushing and shattering has taken place, and remnants of oil in fault traps are all that have been formed.

Drilling at El Mene was easy and the average depth of wells was 1000 ft. Producing-sand thicknesses average 25 ft. The oil is of mixed base, sulphur-free, and of gravity 32° A.P.I. (0·865). E. N. T.

382. Danish Wildcat Abandoned, Additional Tests Planned. Anon. *Oil Gas J.*, 8.1.48, **46** (36), 44.—A test in Ringkobing Province has been abandoned in Lower Mesozoic at 7985 ft. G. D. H.

383. Tomorrow—A 600,000 brl Daily Production. W. F. Moore. *Oil Gas J.*, 27.12.47, **46** (34), 162.—The Arabian–American Oil Co. has concessions of about 440,000 sq. miles in Arabia. The proved reserves are estimated at 6,000,000,000 brl. 58 wells are producing nearly 300,000 b.d., and 115,000 brl are refined daily at Ras Tanura. Dammam has 31 wells in the Arab zone and 2 in the Bahrein zone. The field covers about 9000 acres and has 4 oil zones with a total thickness of about 500 ft. Its daily output is about 9000 b.d. Abqaiq produces 190,000 b.d. from 24 wells. The upper zone covers 10,000 acres, and is some 90 ft thick; the lower zone is 235 ft thick, and extends over 60,000 acres. Qatif also has two zones. Two wells give 4000 b.d. Buqqa has 2 wells, but is not producing. Oil has been found at Abu Hadriya, 100 miles north of Dammam. Shows have been found in an 11,000-ft well at Al Jauf in north-east Saudi Arabia.

It is planned to produce 600,000 b.d. in 1950. There are pipelines connecting Abqaiq, Dammam, Bahrein, and Ras Tanura. A 1040-mile pipeline from Abqaiq to near Sidon in Lebanon is planned. The capacity will be 300,000 b.d., and its cost is placed at $125,000,000.

General conditions with relation to oil operations in Saudi Arabia are described, and there is some discussion of future developments with regard to pipelines, etc. G. D. H.

384. Geology and Water Resources of Southern Okinawa (Japan). D. J. Cederstrom. *Bull. Amer. Ass. Petrol. Geol.*, 1947, **31**, 1752–1783.—This report deals with the southern third of the island of Okinawa, and particularly with the structural geology and water resources. The rocks present are Palæozoic schists, the Shimajiri formation of Miocene–Pliocene age, the Ryukyu limestone of Upper Pliocene or Lower Pliocene age, and recent beach sands, coral reefs, and alluvium. The Shimajiri formation laps upon the schist and was folded before the deposition of the Ryukyu limestone. The Ryukyu limestone and older rocks were gently folded along northwest–southeast axes. Compaction of the sediment over a buried ridge of schist created the Buckner anticline, the axis of which runs north-northeast and south-southwest. E. N. T.

385. New Zealand Oil Exploration Discouraging. Anon. *Petrol. Engr*, Nov. 1947, **19** (2), 166.—New Zealand Oil Exploration Co., Ltd., held concessions in Gisborne, Hawkes Bay, Taranaki, and Westland. Exploratory work began in 1938. Structural drilling was undertaken in Westland in 1940–43, and small oil indications were noted. Shallow production had been obtained at Kotuka many years before. A test well 12 miles from Hokitika was abandoned at 28,000 ft, and then further exploratory work by this company ceased. G. D. H.

Geophysics and Geochemical Prospecting.

386. Electrical Borehole Measurements. J. M. Bruckshaw. *Petroleum*, Nov.–Dec. 1947, **10**, 247.—Full details of the electrical method of logging boreholes are given. F. W. H. M.

387. Geophotometric Mapping is New Surveying Method. Anon. *World Petrol.*, Nov. 1947, **18** (12), 95.—The new instrument uses a camera mounted like a surveyor's transit, and, after levelling and sighting, the rod is photographed on 35 mm film. The distance, direction, and elevation difference are recorded in a single shot. In an average day's work of 50 instrument set-ups, 200 field readings are eliminated.

The type of terrain is shown, and the nature of outcrops is recorded. All readings are made in the office. Vertical-angle differences may be read to 6 sec of arc. Stadia distances are read to 3 ft in 1000 ft. Shots involving 5° above or below horizontal can be handled. Elimination of field readings speeds work, and the readings in the office can be checked without a further visit to the field. G. D. H.

388. Shoran Radar. E. B. Stern. *Oil Gas J.*, 15.1.48, **46** (38), 70.—Shoran is of special value in geophysical work in submarine areas, and was employed in the Bahamas airborne-magnetometer survey. It has also been employed in refraction work on land in West Texas.

Two fixed points of known position are required, and a mobile unit which relates itself to them. The ranges are read from dials. The mobile station sends out pulses which are retransmitted by the fixed stations. The range of accuracy is within 100 ft, independent of distance. The working distance depends on the height of the aerials. Base stations may be placed on boats when the coast is low and would not permit large ranges. A Shoran boat has buoyed as many as 125 shot points in a day.

On land, "shots" in surveying can be made over non-permit land with radar. Shoran could also be employed in charting large land areas by establishing third-order triangulation markers up to 400 miles from the nearest reference object. G. D. H.

Drilling.

389. Source and Use of Diamonds in Oil and Gas Well Coring. C. Deely. *World Oil*, Oct. 1947, **127** (6), 87.—Brief descriptions are given of diamond coring bits and diamond reamers. "Black" or "commercial" diamonds, which are unfit for use as gems because of imperfect crystal structure or discoloration, are used in the manufacture of these tools. Such coring bits have been successfully used in Rocky Mountain and Mid-Continent districts to recover almost 100% of the cores with substantial savings in time and money. A list is given of formations which have been cored by diamond bits up to the present time. R. B. S.

390. Controlled Vertical Drilling. R. Sneddon. *Petrol. Engr*, Sept. 1947, **18** (13), 118.—The author stresses the importance of controlled *vertical* drilling as distinct from controlled *directional* drilling. The various techniques by which control of vertical drilling may be accomplished are explained, and methods of checking the verticality, or otherwise, of a borehole are discussed. R. B. S.

391. Drilling Problems in Alaska. K. M. Fagin. *Petrol. Engr*, Oct. 1947, **19** (1), 180.—One of the major problems encountered in drilling in Alaska is the presence of a layer of permanently frozen ground, usually about 600–1000 ft thick, known as the permafrost. Use is, however, made of the permafrost as a foundation for buildings

and derricks, and care is taken to see that it is insulated from the heat of boilers and the like which would be sufficient to thaw it. Cellars and mudpits have to be insulated to prevent freezing and mud, warmed by steam to 60° F, must be kept in circulation in the hole all the time in order to prevent freezing : the mud must not be overheated, however, as this would cause thawing in the walls of the hole resulting in excessive caving. Difficulty has also been experienced in cementing operations : rapid placing of the cement combined with carefully controlled steam heating of the hole has usually proved successful.

The protection of the drilling crew and equipment from the intense cold and prevailing weather conditions is another factor which necessitates careful planning. Transportation of equipment and supplies has also to be thought out well in advance. Supplies can be shipped to a point on the coast for only a few weeks during the summer months when the ice moves out. During the ensuing winter months these supplies can be moved to the drilling locations by tractor-drawn sledge "trains." In other circumstances supplies have to be transported by planes. Extensive use is, of course, made of radio communication. R. B. S.

392. Largest Mechanical Barge Drilling Rig. E. Short. *Oil Gas J.*, 15.1.48, **46** (37), 62.—The barge is 150 ft × 50 ft × 16 ft and carries a rig powered by four 250-h.p. diesel engines. Auxiliary power equipment consists of five diesel engines. Diagrams and photographs illustrate features of the barge. C. G. W.

393. Mobile Rotary Rig for Rat-Hole Drilling. J. C. Albright. *World Oil*, Oct. 1947, **127** (6), 119.—A special lightweight rig for rat-hole and conductor-pipe drilling is briefly described. R. B. S.

394. New Portable Electric Rig. H. David. *Oil Gas J.*, 20.12.47, **46** (33), 61.—The Shell Co. have designed a portable 900-h.p. rig for drilling depths of 10,000 ft. Points of interest are : (1) The derrick. This consists of a 123-ft twin-mast A-frame. It does not require guy wires and is not cross-braced between the legs of the A-frame. The hook-load capacity is 300,000 lb and the derrick telescopes into a unit 8 ft × 8 ft × 63 ft for transport. The mast is raised and lowered hydraulically and safety devices are incorporated for safe operations. (2) The draw-works are mounted on a permanent turntable, under the derrick floor, for convenience in dismantling and erecting, and are easily set in place from a truck by hydraulic jacks. (3) To enable bases and sub-bases to be made light and portable, all major drilling loads, the weight of racked drill pipe, and the weight of the rotary table and suspended pipe are imposed directly on the ground. The rotary table electrical and electronic control equipment (eddy current brakes, weight regulator, and indicator) are also described. All units except the mast, draw-works, and sub-base are mounted on full or semi-trailers for portability. C. G. W.

395. Special Trailer Speeds Derrick Moves. E. Sterrett. *World Oil*, Oct. 1947, **127** (6), 100.—The use of a special trailer for derrick transportation in shallow drilling operations is described. It is only necessary to remove the crown block and draw-works to enable the removal of the derrick to be accomplished. R. B. S.

396. Oilfield Equipment Manufacture in Germany. Anon. *Petrol. Times*, 17.1.48, **52**, 63.—This is a summary of B.I.O.S. Final Report No. 1317, on the design, production, and utilization of German oilfield equipment. C. G. W.

397. Electric Logging Developments in the U.S.S.R. Resistivity of Mud-invaded Formations. H. Guyod. *World Oil*, Jan. 1948, **127** (9), 67.—No data are available on the distance over which there is transition horizontally from a fully filtrate-invaded zone to the non-invaded sector. The formation factor is always greater than unity, ranging from 3 for very porous sands to more than 100 for well-cemented beds ; the average for petroleum reservoirs exceeds 6. The resistivity of the invaded zone will be much greater than that of the mud except for fresh-water-bearing beds, the interstitial water will be more saline than the mud, and in the absence of oil the formation resistivity will be lower than that of the invaded zone.

Departure charts have been calculated for thick formations invaded by mud, and

some of these are presented. Their general features are analysed. The curves show three arcs. The first corresponds with small electrode spacings, and its shape depends primarily on mud resistivity, hole diameter, and the resistivity of the invaded zone. The next arc has reversed curvature, refers to moderate electrode spacings, and is determined mainly by the invaded zone. The third arc again reverses the curvature, corresponds with wide spacings, and is influenced mainly by the normal formation.
G. D. H.

398. Boats Serve as Mud Pits for Workover Rig. H. M. Pearce. *World Oil*, Oct. 1947, **127** (6), 112.—The use of disused steel pontoons as mud tanks is briefly discussed.
R. B. S.

399. Pressure Welding. A. L. Burns, Jr. *World Oil*, Oct. 1947, **127** (6), 92.—A description is given of a pressure-welding machine. Pressure-welding technique can be used for the welding of line pipe and the affixing of upset and tool joints to drill pipe. The manner in which high-grade welds can be assured is also outlined: photomicrographs of good and bad welds are shown and discussed. R. B. S.

Production.

400. Meter for Measuring Distribution of Gas Flow in Well Bores. F. Morgan, D. W. Read, and L. L. Gray. *Petrol. Tech.*, Nov. 1947, **10** (6), *A.I.M.M.E. Tech. Pub. No.* 2276, 1–16.—The hot-wire anemometer has been applied to measure gas velocities in the well bore. The apparatus is lowered into the well with continuous recording, but the rate of descent must be low relative to the gas flow unless corrections are applied. The meter is calibrated by passing known quantities of gas.

A number of examples of the use of the instrument are described. When gas is being injected, it is possible to deduce the effective formation permeability, and in the cases described there was a general agreement between permeability and flow-meter logs.

Details of the construction of the instrument in the simple and differential forms are given. G. D. H.

401. Interpolation of Well Test Data in Gas-Condensate Fields. J. O. Lewis. *Petrol. Engr*, Sept. 1947, **18** (13), 180.—See Abstract No. 221 (1947).

402. New Long Stroke Hydraulic Pump Unit. L. S. McCaslin, Jr. *Oil Gas J.*, 15.1.48, **46** (37), 87.—This hydraulic unit has a normal stroke of 20 ft at 8 s.p.m. In operation, pressure built up in an accumulator and maintained in a closed system completely balances the rod load. To reciprocate the rods, a small centrifugal pump raises and lowers the pressure on a piston. The maximum pressure is 250 p.s.i. In use, no rod breaks occurred on a well where breaks were frequent and oil production increased considerably. Procedure in well servicing, and operating data on an installation are given. C. G. W.

403. Pumping Dually Completed Wells. T. P. Hoffer. *Petrol. Engr*, Sept. 1947, **18** (13), 204.—A description is given of a pump suitable for producing dually completed wells. The pump has four main assemblies: (1) a positive displacement pump to produce the upper pay; (2) an annular-type packer without slips that has separate passages for the fluids from the two pays; (3) a polished rod attached to the upper plunger connecting cage that actuates a lower pump and a pack-off unit that separates the two pays within the tubing; and (4) a positive displacement pump to produce the lower pay. The method of installing the pump is also described. R. B. S.

404. Pumps De-water Flooded Oil Zone. R. Sneddon. *Petrol. Engr*, Sept. 1947, **18** (13), 51.—The production history of the Kern River oilfield in California is reviewed. Water production has always been a serious problem in this field, and this led to a general shutdown of the field in 1925. Commencing in 1940 the shut-in wells were gradually put on production again, and a unique dewatering programme was instituted. The use of shaft-driven turbines to pump large quantities of water from strategic wells at rates in excess of those at which the water accumulates has actually

resulted in a gradual lowering of the water level, thus enabling an increasing number of wells to be placed on production. In 1940 there were 2075 acres of comparatively water-free sand: the extent of the water-free sand area was increased to 2925 acres by 1943 when 2003 wells were producing 271,318 brl of oil and 6,361,295 brl of water per month. There are now 3300 acres of water-free sand, whilst the number of producing wells has increased to 2237 yielding 291,660 brl of oil and 5,005,098 brl water per month.

The various aspects of the dewatering operation are discussed. R. B. S.

405. Residual Oil Content of Flooded Sands by Chip and Diamond Cores. R. V. Hughes and R. J. Pfister. *Producers' Monthly*, Oct. 1947, **11** (12), 39.—Results are presented of core analyses of both chip and diamond cores taken from a water-flooded sand in the Bradford area, and the results obtained by both methods are compared. The results of these tests are summarized as follows: (1) a comparison of diamond and chip cores taken 8 ft apart showed reasonably good overall agreement as to oil content, residual oil saturation, and effective porosity, although individual measurements varied as much as 10–100% in some instances; (2) the upper more permeable section of the sand tested showed a residual-oil saturation of 30–40%; and (3) adjacent diamond-core samples analysed by two different laboratories showed large variations in permeability especially in the higher permeability range, but the variation between such alternate samples was not greater than the variations in permeability in a single 2-6-in-core sample. R. B. S.

406. Core Analysis—Its Interpretation and Application in Reservoir Engineering. J. G. Caran. *Petrol. Engr*, Oct. 1947, **19** (1), 228.—The fundamental considerations pertaining to core analysis are reviewed, and the use of core analysis data in production is discussed. Formulæ are presented for calculating oil in place and maximum recoverable oil. Fifteen references are appended. R. B. S.

407. Transparent Model of Reservoir Showing Displacement of Oil by Cojoint Injection of Gas and Water. F. Squires. *World Oil*, Oct. 1947, **127** (6), 145.—The use of cojoint injection of gas and water as a method of maintaining initial pressures and rates of production throughout the life of an oil pool is discussed. A description is given of a model oil reservoir which can be used to demonstrate the principles of this method. Cojoint injection ensures that the oil–water and gas–oil contacts will remain horizontal and result in a steady displacement of oil with less fingering or channelling, assuring maximum oil recovery from the reservoir. R. B. S.

408. Study of the Relationship between Grain Size and Capillary Pressure Curves. M. J. Popovich. *Producers' Monthly*, Oct. 1947, **11** (12), 27.—The static distribution of fluids in an oil-bearing formation is primarily affected by the capillary forces which are acting. Information regarding the static distribution of interstitial water is particularly valuable for: (1) making a more accurate determination of reserves; (2) solving dynamic flow problems in primary and secondary recovery; and (3) correlating with existing core-analysis data. The investigations described in this paper were designed to study the effect of grain-size distribution upon capillary pressures, which, in turn, affect the interstitial water distribution.

A description is given of the apparatus used to determine the relationship between capillary pressures and saturations, and of the method of preparing the core samples. In all, 23 cores of varying porosity and permeability were studied, and using the data obtained from these investigations capillary pressure *versus* saturation curves were plotted for each core. The core samples were then carefully broken down into the individual sand grains and the grain-size distribution determined by sieve analysis. The experimental results are tabulated and the following data are given for each of the 23 cores examined: (1) sieve analysis in per cent by weight of 30–40; 40–50; 50–60; 60–80; 80–100; 100–140; 140–200; and 200 plus mesh (none of the cores examined contained sand grains greater in size than 30 mesh); (2) permeability, millidarcies; (3) porosity, per cent; (4) minimum or residual water saturation; and (5) uniformity coefficient: this was a measure of the uniformity of grain size. Curves are plotted showing the relationship between grain-size distribution and minimum water saturation, hence capillary pressures. These results are discussed.

The author draws the following conclusions: (1) owing to the statistical nature of the investigation a larger number of cores must be tested before quantitative relationships can be established; (2) there is a tendency for minimum water saturation to increase with the amount of fine-grained particles in the sand; several unsuccessful attempts were made to correlate the quantity of the large-size sand grains and the displacement pressures (minimum capillary pressures); (3) minimum water saturation tends to increase as the grain size, corresponding to the ninety percentile point on a standard-frequency accumulative curve, decreases; and (4) the presence of mica in one sample appeared to affect the shape of the capillary-pressure curve, in general, increasing the capillary pressure for a given saturation: further investigations may reveal the extent and direction in which various minerals may affect the curves. The author also points out that a variety of consolidated sands of varying physical and chemical properties was used, and he suggests that in future investigations of this nature, only samples taken from the same horizon or stratum should be used in order to minimize variations which naturally exist between sands of dissimilar geologic origin.

An excellent bibliography of twenty references is appended. R. B. S.

409. Temperature Surveys in Producing Wells. C. R. Dale. *Petrol. Engr*, Sept. 1947, **18** (13), 146.—The interpretation of data obtained from thermometric surveys in producing wells is discussed: several examples of the practical use of this type of information are also described. Thermometric surveys can be used to obtain information of various factors such as: (1) the lowest depth from which a well is producing; (2) the position of casing and tubing leaks; and (3) the existence of gas, oil, or water migration behind the casing. The author suggests that by the frequent use of thermometric measurements, production operators may build up a background of experience which will prove to be of value in the elucidation of many production problems.

R. B. S.

410. Prevention of Microbiological Growths in Water Flood Operations. J. V. Beck. *Producers' Monthly*, Oct. 1947, **11** (12), 21.—Bacteria, algæ, and other micro-organisms are present to some extent in all untreated surface and stored waters. Such waters, when used in water-injection operations, are known to cause plugging of the sand faces of the input wells: of particular importance is the fact that bacteria tend to selectively plug the *tighter* sands, thus making it more difficult to recover the oil from these sands which may be presumed to contain larger percentages of their original oil than sands of higher permeability.

Field testing has shown that the usual procedures for arresting bacterial growth using chlorine and hypochlorite are not adequate. Laboratory investigations were carried out to determine the effectiveness of the following bactericides: (1) phenyl mercuric lactate; (2) lauryl pyridium chloride; (3) lauryl dimethyl benzyl ammonium chloride; (4) cetyl dimethyl ethyl ammonium bromide; (5) sodium pentachloro phenate; and (6) formaldehyde. In general, these laboratory investigations showed that the necessary concentrations of these bactericides was so high that they could not be economically used in the field. Lauryl pyridium chloride was found to be effective at concentrations of about 15 p.p.m. and due to its other desirable characteristics was chosen for some field tests. No beneficial action has been noted after some 4 months of application. Certain micro-organisms (*Pseudomonas*) soon became predominant in the treated water, and it was apparent that they were highly resistant to the action of the bactericide. Formaldehyde has been found to be effective against sulphate-reducing bacteria; but treatment of water with formaldehyde makes it unsuitable for human consumption because of its poisonous nature, and consequently certain precautions have to be observed when it is used. Quaternary ammonium compounds were not as effective against sulphate-reducing bacteria as against most aerobic bacteria, but they are non-toxic and they possess desirable "wetting-agent" properties as well as bactericidal properties. The mercurials in general and sodium pentachloro phenate are poisonous and relatively insoluble, so that care must be taken to ensure that they are soluble in the input water at the necessary concentrations. Low-pH waters were found to inhibit bacterial growth, but such waters are, of course, corrosive. Field tests using formaldehyde and acid water are contemplated. Eleven references are appended. R. B. S.

411. Salt Water Injection and Pressure Maintenance in the East Texas Oilfield. W. S. Morris. *Petroleum*, Sept. 1947, **10**, 209.—In the East Texas Oilfield, decline in reservoir pressure has been halted by the introduction of a salt-water injection system which returns salt water produced to the Woodbine Sand reservoir.

Pollution of fresh-water streams has been eliminated in the area, and it is estimated that over 600 million additional brl of oil will be recovered from the field as a result of adoption of the salt-water disposal programme. Statistical data are presented.

F. W. H. M.

412. Water Flood Spacing. S. T. Yuster. *Oil Gas J.*, 20.12.47, **46** (33), 70.—Factors to be considered in estimating well-spacing for maximum profit are: (1) Ultimate oil recovery; (2) Time limit for flood completion; (3) Development and operating costs. Spacing may be obtained as a function of well depth, recovery per acre, price of crude, and surface flooding pressure, and a comparison of flowing and pumping production made. When taking the maximum flood-out time into consideration the spacing may be expressed in terms of the effective well radius, effective permeability, recovery per acre/ft, well depth, and applied surface pressure. A relation is obtained for deriving the gross profit on an operation, and practices leading to more economical development discussed.

C. G. W.

413. Stratigraphic Rearrangement of Water Rates in Input Wells. R. J. Pfister and D. L. Evans. *Producers' Monthly*, Oct. 1947, **11** (12), 14.—The stratigraphic rearrangement of water rates in input wells by plugging-off watered-out sands, fractures, and crevices, and by increasing the water intake in tight-sand sections of higher oil saturation is discussed. Field methods of testing and of carrying out these operations and the results of operations on certain wells in the Pennsylvania Grade region are also described.

The author draws the following conclusions: (1) the efficiency of an input well can be increased by selectively plugging strata of high water intake and low oil content, by selectively acidizing less permeable sands of low water input and high residual oil content, or by a combination of both; (2) water input profile measurements enable suitable remedial treatments to be evaluated; (3) Dresinol 236 (a rosin-emulsion-type plugging material) was proved to be a highly selective plugging material for permeable sands and did not overplug tight sands, but was unsuitable for plugging a crevice, fracture, or packer leak; (4) a coarse oil-base plugging material was found suitable for plugging crevices without affecting the rest of the well; and (6) silica gel could be used successfully to plug watered-out sands in some cases: it has the advantage that it cannot be flocculated or made permeable by later applications of acid.

Four references are appended.

R. B. S.

Oilfield Development.

414. Survey of World Oil Fields. Anon. *Oil Gas J.*, 27.12.47, **46** (34), 171.—Data are given on the world oilfields, including the discovery year, numbers of flowing and pumping wells, producing depth, average daily output, cumulative production, wells drilling, producing formation, and oil gravity.

G. D. H.

415. Production up Sharply in Response to World Demand. W. W. Burns. *Oil Gas J.*, 27.12.47, **46** (34), 154.—During 1947, countries outside the U.S.A. and the U.S.S.R. are estimated to have averaged 2,657,000 b.d. of oil production, 329,000 b.d. more than in 1946. The Middle East gave 858,000 b.d. in 1947, the wells averaging about 4000 b.d. each. Venezuela averaged 1,187,000 b.d., and its wells averaged nearly 240 b.d. each.

A table gives the daily output of the various countries for 1947, 1946, and 1938, and short notes are given on some of the leading countries.

Exclusive of Russia the daily oil demand is estimated now to be 8,093,000 b.d.

G. D. H.

416. World Production Rose 9% in 1947. Anon. *World Petrol.*, Jan. 1948, **19** (1), 42.—In spite of equipment shortages world oil output was 8,224,000 b.d. in 1947, an increase of 684,900 b.d. over 1946.

The areas with the main increases were U.S.A. (329,000 b.d.), Venezuela (123,000 b.d.), Middle East (123,400 b.d.), U.S.S.R. (54,000 b.d.), and Indonesia (32,600 b.d.).

Saudi Arabia has 67 wells giving an average total of 24,500 b.d. The U.S.S.R. output averaged 505,000 b.d. in 1947, and that of Venezuela 1,187,000 b.d.

A table gives the average oil output per day by countries for 1939, 1946, and 1947, and an estimate for 1948. G. D. H.

417. Depth Trends. H. David. *Oil Gas J.*, 29.1.48, **46** (39), 160.—During 1947 the footage drilled in the U.S.A. was 114,013,000 ft, thus exceeding the 1941 record of 98,509,000 ft. 36% of the footage was in Texas, 18% in Oklahoma–Kansas, and 8% in California. The average well depth was 3445 ft, the record being 3469 ft reached in 1945.

Diagrams show footage and depth trends in various areas. G. D. H.

418. Drilling Forecast. C. J. Deegan. *Oil Gas J.*, 29.1.48, **46** (39), 152.—The 1948 drilling programme in the U.S.A. involves 36,612 wells with a total footage of 131,744,000 ft. There may be 6296 exploratory wells. 11,503 wells are planned in Texas, 3867 in Oklahoma, and 2939 in Kansas.

A table gives, by States, the field and wildcat wells planned for 1948, together with their footage, and the changes from 1947 figures. G. D. H.

419. Completions. J. C. Casper. *Oil Gas J.*, 29.1.48, **46** (39), 154.—During 1947 33,098 wells were completed in the U.S.A. The 27,637 development wells included 17,127 oil wells, 3057 gas wells, 5173 dry holes, and 2280 service wells. The 5461 wildcats included 864 oil wells and 248 gas wells. The total was 874 below the record figure in 1920.

Texas has 9310 completions of which 1895 were wildcats. Oklahoma had 3003 development wells and 843 wildcats. Pennsylvania was third with 3238 completions.

23,200 rotary wells and 9898 cable-tool wells were drilled in 1947.

Tables give, by States, for 1947 the numbers of rotary and cable-tool completions, the numbers of development and wildcat wells, broken down according to results, the total completions, with footage and subdivided with regard to types, and the total completions and footage yearly from 1940 onwards. G. D. H.

420. Completions May Reach 33,600 for 1947. Anon. *World Oil*, Jan. 1948, **127** (9), 60.—2992 wells were completed in the U.S.A. in November 1947, giving an eleven-month total of 30,625. A table summarizes the results of these completions by States. G. D. H.

421. Record Breakers : New Records Set for Both Drilling and Producing Depths. P. DeArmond. *Oil Gas J.*, 29.1.48, **46** (39), 158.—The world's deepest well was completed at 17,823 ft in 1947 in Caddo County, Oklahoma. The Queen Bess Island discovery well, Jefferson Parish, South Louisiana, produces from 13,904 ft.

Tables give the U.S. drilling and producing depth records by States. G. D. H.

422. Middle East Developments. Anon. *Petroleum*, Oct. 1947, **10**, 220.—The present and future scope of Middle East oil production is discussed and compared with that in the U.S.A.

A map is given showing fields, refineries, and the various companies' concessions. Pre-war, post-war, and estimated future production statistics are included. F. W. H. M.

423. Oil in Iran. Anon. *Petroleum*, Oct. 1947, **10**, 223.—The production of crude oil in Iran now amounts to 19 million tons a year—twice that for 1939.

The four main producing fields are Haft Kel, Agha Jari, Masjid-i-Sulaiman, and Gach Saran. Production at Masjid-i-Sulaiman amounted to approximately 3,674,000 tons during last year. Most of the fields are being successfully developed, new wells being drilled, and pipelines installed.

Abadan refinery receives over 8 million g.p.d. of crude and the two latest distillation units have a capacity of 3 million g.p.d. of crude.

To keep pace with refinery expansion, power supplies and water-pumping capacity are to be extended.

The Anglo-Iranian Oil Company's contributions to the development of the education, health, and living conditions in Iran are considerable. Several million pounds have been spent during the past year on general services and education. F. W. H. M.

424. Kuwait. Anon. *Petroleum*, Oct. 1947, **10**, 221.—Conditions in Kuwait and plans relating to development of the oil industry there are described. Production in 1946 was about 40,000 b.d. Preliminary estimates of reserves are given as 4–8 billion brl of oil. F. W. H. M.

Transport and Storage.

425. Commingling. Influential Factors in a Products Pipeline. D. A. Roach. *Pipe Line News*, Jan. 1948, **20**, (1), 8.—Methods of commingling or intermixing control used by the Phillips Petroleum Co. are described. To minimize intermixing, the sequence of products is controlled, and separate suction lines used, lines washed and drained or connexions blinded off. Dead fluid in station equipment is a major source of commingling, and the leading portion of the slug is used to wash dead fluid from equipment. Steps taken at the stations are: (1) bypass, drain, and pump the contents of the sediment trap back into the line before the product arrives; (2) place all pumps in operation 15 min before the product arrives; (3) wash station bypass with the product through a scraper kick-off line. C. G. W.

426. Gauging Methods in Atmospheric and Low-Pressure Storage. C. C. Keane. *Pipe Line News*, Jan. 1948, **20** (1), 11.—There are three categories of gauging methods, the pole or hand-line, float-operated automatics for reading at the tank, and remote reading units. A disadvantage of the remote-reading method is that sampling gravity and temperature determinations cannot be remotely transmitted. The remote gauge offers advantages where several tanks are simultaneously in operation. Some of the prominent units for remote gauging—selsoyn units, impulse relay gauges, and step contact gauges—are briefly described. C. G. W.

427. Construction of Large All-welded Storage Tanks. M. R. Large. *Bull. Ass. franç. Tech. Pétrol.*, 1948, (67), 21–42.—A description is given, in some detail, of the use of electric welding in tank construction. A safety factor of 2·7 is recommended, the steel used having a tensile strength of 40–45 kg/cm^2. Diagrams show welding procedure for various sizes of tank, weld details are illustrated by photographs. V. B.

428. Modern Oil Tankers (2). R. Hammond. *Petroleum*, Sept. 1947, **10**, 202.—A detailed description and operating conditions of the 6000-s.h.p. John Brown–Escher Wyss closed-cycle gas turbine marine unit is given.

Variable-pitch propellers by the same manufacturers are also described and diagrams given.

Tank cleaning, safety precautions, fire risks in tankers, and corrosion problems are discussed. F. W. H. M.

429. Modern Oil Tankers (3). R. Hammond. *Petroleum*, Oct. 1947, **10**, 226.—The modern trend in tanker design is towards much larger vessels. As an example of a very large tanker a modern whale-factory ship is described.

The B.T.H. turbo-electric plant in the tanker *Helicina* is described with an explanatory diagram. The turbine governor gear for this plant has special features which are discussed in detail.

Interesting facts regarding other modern vessels are given.

Recent statistics show that, during 1946, 58 tankers were launched in the world, of which 37 were motorships and 42 were built in Great Britain and Ireland.

F. W. H. M.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

430. Maintenance of Stainless Steel Equipment in Refineries. I.—Types and Their Applications, Welding, Intergranular Corrosion. W. G. Renshaw. *Petrol. Process.*, Jan. 1948, **3** (1), 25–28.—Thirty types of stainless steel are now available for refinery equipment, ranging from straight chromium steel containing only 4·6% chromium (for needs where heat and corrosion resistance only slightly better than those of common steel are required), to alloys containing as much as 30% chromium or other elements such as nickel, molybdenum, silicon, columbium, and titanium.

The type of corrosion most commonly met with in stainless steels is intergranular or intercrystalline, due to precipitation of chromium carbides at the grain boundaries. Under severe conditions, such as high temperatures, small electro-chemical cells are set up between carbide and normal alloy which can cause rapid attack at the boundaries. Annealing is sometimes employed to remove precipitated carbides, but a better method is to prevent their formation. Other methods outlined are the use of chill plates, and low carbon steel.

Intergranular corrosion during welding can be minimized by keeping the speed with which the weld bead is laid as great as possible. Spot welding is also frequently employed, since it involves heating for so short a time that carbides do not develop. Suitable welding jigs should be used to hold parts in place, otherwise carbon precipitation during welding may be accelerated.

The new heliarc and atomic-hydrogen welding processes have now completely eliminated the use of acetylene welding for light gauges, and with it the dangers of carbide precipitation due to carbide pick-up in the metal from the hydrogen gas.

W. M. H.

431. Straight-Line Chart Determination of Absorber-Extraction Efficiency. E. G. Ragatz. *Oil Gas J.*, 12.2.48, **46** (41), 78.—A recently proposed straight-line chart method of absorber analysis has been modified with the resultant development of a highly significant overall-performance factor. The factor, termed extraction efficiency, expresses the ratio of the theoretical minimum to actual lean-oil rate required to effect a 95% butane recovery at any particular absorber effectiveness under any given base conditions of absorber operations.

The application of this factor to a wide range of commercial units indicates the possibility of considerably improving the efficiency of modern high-pressure absorbers. It is shown that, for example, all columns, irrespective of design, vary substantially in extraction efficiency with any substantial change in vapour and/or liquid loading; and many low-pressure columns operate at very satisfactory efficiencies, whereas some modern high-pressure columns do not.

Eight figures illustrate the article. G. A. C.

432. Ultrahigh-Frequency Sound Waves Measure Thickness of Metal from One Side. N. G. Branson. *Oil Gas J.*, 22.1.48, **46** (38), 66.—An instrument (the "Audigage") and its application to determine thickness of a metal wall from one side by determining the fundamental natural frequency of vibration of the wall is described. Thickness of steel ranging from ¼ in to 12 in can be determined within an accuracy of 2%. A skilled operator can also predict condition of a hidden surface, such as presence of coke or scale.

Examples of performance are given in three tables. G. A. C.

433. Steam Flow Through Orifices. W. L. Nelson. *Oil Gas J.*, 22.1.48, **46** (38), 103.—No. 180 in the *Refiner's Notebook* series gives a chart by which the amount of steam used for cleaning tanks, coils, exchangers, or for heating liquids, etc, can be determined without the use of a meter.

The fact that rate of flow of steam through an orifice is a constant, depending on properties of steam and size of orifice, is used. An example is worked out.

G. A. C.

Distillation.

434. Some High Points in Gasoline Plant Design. V. E. Middlebrook. *Oil Gas J.*, 12.2.48, **46** (41), 98.—Factors affecting gasoline-plant design are discussed, with reference to liquefied-petroleum-gas recovery. The disposition of plant residue gas is an important factor affecting plant design, and the type of gas, *i.e.* rich, medium, or lean, also affects design.

A very rich gas, low in methane and ethane, can be successfully processed by a combination of compression, refrigeration, and stage flashing.

Certain inlet gases are sufficiently rich in the heavier hydrocarbons to allow for efficient recoveries by vapour rectification. The criteria here are the condensing units which again depend on quality of cooling water. To obtain high still-bottom temperatures direct-fired heaters are used, with still pressure as high as 80–100 p.s.i.

The handling of recycle or non-condensable vapours presents difficult problems, for example, the most economical arrangement of fractionating equipment.

It is good design to de-ethanize the entire raw make, feeding the bottom product to columns operating at successively lower pressures to yield the required final products.

G. A. C.

Cracking.

435. Catalytic Cracking. G. Egloff. *Chim. et Ind.*, 1948, **59**, 121–127.—A brief description and simplified flow diagrams are given for the fixed-bed, moving-bed, and fluid-flow processes. The surface area of the alumino-silicate catalyst is stated to be of the order of 500,000 sq. m/kg. V. B.

Metering and Control.

436. Electronic Pipe Locators and Leak Detectors. H. David. *Oil Gas J.*, 15.1.48, **46** (37), 75.—The pipe locator determines exact position of buried pipelines and other services, also depth of pipe beneath surface and its course. The locator consists of a radio transmitter and a receiver, the volume of sound heard determining position of the metal.

Leaks are found by a suitable listening device which detects vibrations produced in the punctured pipe by the escaping fluid. The exact location can be found without actual contact with pipe, and an accuracy of within 9 in is reached in operations in metropolitan areas of California.

Operation procedures and diagrams are given. G. A. C.

437. Seals for Oil Process Pumps. Anon. *Gas Oil Pwr*, 1948, **43** (509), 49.—Developed for use in oil refineries, the essential part of this device is a stainless-steel sleeve, to which a static seal is attached so that quenching water cannot penetrate under the sleeve. A stainless-steel spring fitted to the sleeve bears against the rotary-seal ring in such a manner that its grip tends to be increased in operation. Holes are provided in the seal covers to permit a controlled flow of oil around the seal rings, thus removing frictional heat and preventing sediment formation. With hot-oil pumps this oil stream is cooled before entering the cover. H. C. E.

Products.

Chemistry and Physics.

438. Dual Surface B.E.T. Adsorption Theory. W. C. Walker and A. C. Zettlemoyer. *J. Phys. Coll. Chem.*, 1948, **52**, 47.—The theory presented is based on the multimolecular adsorption theory of Brunauer, Emmett, and Teller, and involves the concept of an adsorbing surface made up of two surfaces whose heats of adsorption are different. D. F. J.

439. Statistical Mechanics of Multimolecular Adsorption. III. Introductory Treatment of Horizontal Interactions, Capillary Condensation, and Hysteresis. T. L. Hill. *J. Chem. Phys.*, 1947, **15**, 767–777.—The elementary treatment of interactions and

first-order phase changes in localized and mobile monolayers is reviewed, and calculations on multimolecular adsorption and capillary condensation presented. Several other topics, including the quasi-chemical method and reversible hysteresis, are briefly discussed. D. F. J.

440. Some Correlating Principles of Detergent Action. W. C. Prest. *J. Phys. Coll. Chem.*, 1948, **52**, 84–96.—Detergency curves for sodium laurate, myristate, palmitate, and stearate were obtained by measuring photometrically the whiteness of cotton muslin, previously soiled with lamp-black and vaseline, after washing with the soap. The curves show a critical washing concentration which is characteristic of each detergent, which coincides with its critical concentration of colloid formation, and which is essentially a function of the length of the nonpolar tail of the detergent molecule. The latter is characterized both by great length and by a dual hydrophylic–hydrophobic nature.

Various physical properties of sodium dodecyl sulphate are plotted against concentration. Each curve shows an inflexion occurring within a small concentration band. It is deduced that detergent action, colloid formation, and surface activity are manifestations of the same property. D. F. J.

441. Volumetric Analysis of Colloidal Electrolytes by Turbidity Titration. J. M. Lambert. *J. Coll. Sci.*, 1947, **2** (5), 479–493.—In this method an anionic surface-active material is titrated with a cationic agent under such conditions that a colloidal precipitate is formed near the equivalence point and is solubilized or coagulated by a small excess of reagent. The end point of the titration is indicated by the maximum turbidity of the solution, detected with an ordinary colorimeter. Three suitable instruments are described, and in a theoretical section it is pointed out that since the amount of scattered light is inversely proportional to the fourth power of the wavelength of incident light, the amount of transmitted light can be varied over wide limits by using different filters. Graphs are given illustrating the sharpness of the end point, and results are quoted for eight anionic and four cationic surface-active agents. It is necessary to introduce a correction factor to compensate for the fact that the end points and equivalence points do not exactly correspond, and this varies between 0·86 and 1·12. On solutions ranging from 0·05 to 2·0 g per litre, the accuracy is estimated to be about $\pm 5\%$ of the amount present. H. C. E.

442. Ignition of Explosive Gas Mixtures by Electric Sparks. I. Minimum Ignition Energies and Quenching Distances of Mixtures of Methane, Oxygen, and Inert Gases. M. V. Blanc, P. G. Guest, G. von Elbe, and B. Lewis. *J. Chem. Phys.*, 1947, **15**, 798–802.—An apparatus and experimental procedure is described for measuring capacitances and gap voltages of condensed electric-spark circuits for sparks just powerful enough to ignite explosive gas mixtures. Mixtures of CH_4, O_2, and inert gases are investigated. Minimum ignition energies are calculated from the measured capacitances and gap voltages. These energies are found to be independent of gap voltage. With increasing gap length they attain a minimum at critical distances, which mark the farthest penetration of the flame-quenching effect of the electrode material. Above the quenching distances the energies remain constant over some range which is governed by mixture composition and pressure. Data of such minimum energies and of quenching distances are presented for mixtures at room temperatures and pressures ranging from 0·2 to 1 atmosphere. D. F. J.

443. Ignition of Explosive Gas Mixtures by Electric Sparks. II. Theory of the Propagation of Flame from an Instantaneous Point Source of Ignition. B. Lewis and G. von Elbe. *J. Chem. Phys.*, 1947, **15**, 803–808.—A theory is developed for the ignition of mixtures of CH_4, O_2, and N_2 described in a previous paper (See Abstract No 442, [1948]). It shows the existence of an absolute minimum energy which can be correlated to the burning velocity, the width of the combustion wave, and the thermal conductivity, specific heat, and density of the gas mixture. An explanation is attempted of the marked difference between lean and rich mixtures of CH_4 and O_2. D. F. J.

444. Structure of *cyclo*-Octatetraene. H. S. Kaufman, I. Fankuchen, and H. Mark. *Nature*, 1948, **161** (4083), 165.—The structure of *cyclo*-octatetraene was determined by X-ray methods, and the crystallographic data are given. Of the four possible structures for the molecule, the " tub " form with alternating single and double bonds was found to give the best fit for the experimental data. The bond lengths and angles indicate that the molecule possesses little resonance energy. H. C. E.

445. Structure of *cyclo*Propane. H. A. Skinner. *Nature*, 1947, **160** (4078), 902–903.—Values, which were obtained from electron-diffraction studies, of interatomic distances and angles in *cyclo*propane (I) are quoted. It is concluded that the CH-link, force constant, and H–C–H angle are in agreement with a trigonal structure for I, but, on the other hand, the CC-link is the same as that of paraffinic hydrocarbons. [Reply by A. D. Walsh.] The points made in earlier discussion (Abstracts Nos. 617, 878, 1691 [1947]) are summarized, and it is concluded that both I and ethylene oxide can be regarded as formed from CH_2 groups, the C atoms of which are in a state of hybridization close to that of ethylenic C atoms. The analogy between I and ethylene is primarily one of valencies, for the CCC ring of I could not be expected to show olefinic frequencies. Interpretation of the properties of I in terms of atomic orbitals is also attempted. H. C. E.

446. The Mercury ($^3P_1$) Photo-Sensitized Hydrogenation of Ethylene. D. J. LeRoy and A. Kahn. *J. Chem. Phys.*, 1947, **15**, 816–819.—The reactions were carried out in a fused-quartz annular cell over the range 42–320° C. The course of each reaction was followed both by press changes and by chemical analyses. At 200° C and lower, the results are in relatively close agreement with those of Jungers and Taylor. The activation energy of the reaction $2C_2H_5 = C_2H_6 + C_2H_4$ is estimated to be $\geqslant$1·2 k.cal/mole. Above 200° C ethane formation increases rapidly, corresponding to an activation energy $\geqslant$10·5 k.cal/mole for the reaction $C_2H_5 + H_2 = C_2H_6 + H$. The small amount of polymerization was not affected by temperature. D. F. J.

447. Catalytic Dehydrogenation of Ethylbenzene (3). Chemical Equilibrium in Styrene Formation from Ethylbenzene at Low Pressures. J. C. Ghosh, S. R. D. Guha, and A. N. Roy. *Petroleum*, Oct. 1947, **10**, 236.—Data for the equilibrium constants at five different temperatures in the presence of the selected catalyst are presented. The constants have been calculated from the equation :

$$Kp = \frac{a^2}{1 - a^2} \frac{p}{760}$$

where a is the degree of dissociation of a gram mol. of ethylbenzene and p the reaction pressure in mm Hg.

The observed values of the constants are much higher than those predicted by the theoretical equation of Guttman *et al.*

The free energy change of the reaction, heat of reaction, and the entropy change of the reaction, evaluated from the observed values of the equilibrium constant by standard methods, are, at 298° K and one atmosphere pressure, 29,062 cal, 20,229 cal, and 29·64 e.u. respectively. F. W. H. M.

448. Olefin Reactions Catalysed by Lewis Acids. J. W. Baker. *Nature*, 1948, **161** (4083), 171.—The essential feature of the mechanism of this reaction is either (*a*) that addition of a Lewis acid (*e.g.* $SnCl_4$) to an olefin causes separation of a proton from the olefin in the presence of a proton-accepting reagent; or (*b*) that the function of the Lewis catalyst is to produce a carbonium cation. The product formed by the reaction of HCHO with 2-methyl-2-pentene is 3-methyl-3-hexen-1-ol, in accord with (*a*); and not 2-methyl-3-ethyl-3-buten-1-ol as would be obtained with mechanism (*b*). Similarly the reaction of phenyl *iso*cyanate and trimethylethylene results in polymerization of the olefin, the dimeride fraction of which, on ozonolysis, yields only acetaldehyde. This can be readily explained by mechanism (*a*), but not by mechanism (*b*). H. C. E.

449. Critical Temperature and Molecular Weight of *n*-Paraffins. L. Grunberg and A. H. Nissan. *Nature*, 1948, **161** (4083), 170.—The viscosity of liquids at their critical point η_c should be given by:

$$\eta_c = K\left(\frac{\rho_c^4 T_c^3}{M}\right)^{\frac{1}{6}}$$

where ρ_c is the critical density, T_c is the absolute critical temperature, and M is the molecular weight. It is found that η_c and ρ_c are approximately the same for *n*-paraffins between C_3 and C_8, so that M should be proportional to T_c^3, and experiment shows that this is actually the case. For CH_4 and C_2H_6 the values of T_c^3 are lower than the relationship demands, and this is explained by the hypothesis that T_c^3 refers to the number of internal degrees of freedom of the chain. H. C. E.

450. Thermodynamics of the Gas Turbine. J. Van Vollenhoven. *Ingenieur*, 16.1.48, O4–8.—The author shows that the Carnot cycle of isothermal compression, adiabiatic compression, isothermal expansion, and finally adiabatic expansion is the ideal gas-turbine process.

By placing a regenerator in the system of compressor, combustion chamber, and gas turbine the thermal efficiency of the engine is increased. Eleven graphs and charts are included. N. C.

Analysis and Testing.

451. Rapid Method of Analysis for Certain Surface-Active Agents. S. R. Epton. *Nature*, 1947, **160** (4075), 795.—A new method of determining alkyl sulphates, alkyl and alkyl-aryl sulphonates consists in titrating these with a solution of cetyl pyridinium bromide in the presence of methylene blue, chloroform, and sodium sulphate. Under these conditions the methylene blue transfers from one layer to the other, until at the equivalence point the colour of the two layers is the same. The end point is reproducible to 0·1 ml and is not affected by inorganic salt, acids, organic liquids, or small temperature variations. The longer the chain length, the sharper is the end point, and surface-active substances insoluble in water can be dissolved in chloroform and the titration carried out in the usual way. Fatty-acid soaps and substances having more than one ionizable group cannot be estimated. H. C. E.

452. Prediction of Activity of Cracking Catalysts from Heat of Wetting. I. W. Mills. *Oil Gas J.*, 15.11.47, **46** (28), 237.—The activity of conventional natural clay and synthetic bead and polleted cracking catalysts can be ascertained, and time can be saved, by means of a correlation of relevant data and a procedure for determining the heat of wetting of the catalyst when contacted with pure methanol. The development of the method, the pretreatment temperatures and conditions, and conditions for nitrogen-method purging and its correlation with the "catalyst-activity test A" of Alexander and Shrimp (*Nat. Petrol. News*, 1944, **36** (31), R-537) are described; and the data obtained are shown in typical time–temperature curves, and curves relating heat of wetting to "Cat-A activity" for the types of catalysts indicated. The accuracy of the correlation for catalysts of various types (including new catalysts which had been steam-aged to various activity levels, and some used plant catalysts) is shown in a table. Data are also given of the effect of contaminants, *e.g.* water, carbon, and iron, and the effects of blends of catalysts are discussed. If catalysts of the type indicated are properly prepared for the test and no catalyst poisons are present, accurate correlation of activity with heat of wetting can be obtained. In cases where deviation is encountered due to the presence of "poisons," the heat of wetting is still a useful property with which to study the behaviour of catalysts. W. H. C.

453. Simplified Method for Determination of Carbonaceous Deposits on Cracking Catalysts. F. E. Ray and A. E. Potas. *Oil Gas J.*, 15.11.47, **46** (28), 255.—The apparatus and procedure for a rapid and accurate determination of the carbonaceous deposit on cracking catalysts are described. The apparatus is designed for five combustions at a time, though generally only two estimations are required. The development is outlined, and curves are given showing the variation in completeness of combustion with volume of flue gas produced. Briefly the method consists of burning

20 g. of the sample heated to 1100 ± 25° C in a stream of oxygen at the rate of 75 ml/min, and passing the gases over the heated CuO–clay catalyst to a brine-filled graduated receiver, so that 4 l are collected in 90 min, by displacement of the brine to a second receiver. The volume and temperature of the collected gases, and the barometric pressure are noted, and the CO_2 content of the flue gases is determined by an Orsat apparatus. The volume of flue gas is corrected to N.T.P., and for the partial pressure of the water vapour, by means of the correction-factor curves illustrated. Finally, the carbon present on the catalyst is calculated. The data indicate that with all 20-g samples containing up to 6% by wt of carbon, a minimum of 97% of the carbon would be burned when collecting 4 l of the flue gas. The accuracy is ± 3% of the total carbon present in the range of 0–7% by wt on the catalyst. The advantages of the method are: (1) the sample need not be ground; (2) the equipment is simple and inexpensive; (3) five estimations can be made simultaneously with a total elapsed time of 2 hr and an expenditure of 1 man-hr. W. H. C.

454. Apparatus for Micro Gas Analysis. C. Kenty and F. W. Reuter. *Rev. sci. Instrum.*, 1947, **18** (12), 918–924.—The apparatus, which is described in detail, deals with gas volumes of the order 0·01 cc at atmospheric pressure. The gas is liquefied in various parts of the system, and identified by comparing differences between Pirani and McLeod gauge readings and differences in speeds of flow. Hydrocarbons generally are condensed by liquid N_2, but methane and ethylene can only be dealt with by condensation in an appendix cooled by the evaporation of liquid N_2 under reduced pressure. CO and N_2 are estimated by reacting with O_2 over a heated platinum filament and estimating the amount of CO_2 and water formed.

Details of the calibration method and the speed of pumping by the special small mercury-diffusion pumps are given. It is claimed that the apparatus yields results of accuracy within a few per cent. H. C. E.

455. Engine Testing of Fuels and Lubricants. 4. Lubricants (Part 3). P. H. Moore. *Petroleum*, Oct. 1947, **10**, 233.—A table, giving the main features of the C.R.C. L-1, L-3, L-4, and L-5 engine tests which indicate the capacity of an oil to resist different types of oxidation, is given.

Ring-sticking is discussed, and tests to evaluate anti-ring-sticking properties described. In Germany, the D.V.L. Institute concluded that ring-sticking tendency of oils, is primarily dependent on the prevailing temperature in the piston-ring groove. Their test is described.

Speed is claimed to be of primary importance regarding oil consumption, test results having shown that consumption varies as the cube of the engine revolutions. It is stated that although oil consumption decreases with viscosity increase, there is a point at which it begins to increase again. An explanation for this is advanced, methods of recording consumption are described.

Laboratory tests such as carbon residue do not give a true picture of the carbon-forming tendency of an oil in service, but it is claimed that the 90% distillation point (distilled at 1 mm Hg absolute) bears a linear relationship with actual deposits.

The C.R.C., L-2-545 " film strength " test is described. A suggested method for evaluating the capacity of an oil to retain a lubricating film is to cut away one half of the piston crown, thereby assisting blow-by and allowing the hot gases to play directly on the upper ring belt.

The " Chevrolet Sludging Test " is described.

Copper–lead, cadmium–silver, and cadmium–nickel bearing alloys are more susceptible to corrosion than the babbit alloys. It is stated that it is difficult to examine bearing corrosion in any other way than by an engine test. A list of factors governing corrosion is given. F. W. H. M.

456. Alkylation of *iso*Paraffins with Olefins in the Presence of Sulphuric Acid. Part I. The Composition of an Aviation Alkylate. F. Morton and A. R. Richards. *J. Inst. Petrol.*, 1947, **33**, 697.—An aviation alkylate has been submitted to precise fractionation and the physical constants of the fractions determined. Infra-red spectroscopic analysis of a number of the fractions has been used to determine the composition of the alkylate. A. R. W. B.

457. Infra-Red Technique in the Petroleum Industry. M. Robert. *Bull. Ass. franç. Tech. Pétrol.*, 1948, (67), 43–66.—An illustrated lecture giving a general survey of this field. The use of total as well as monochromatic radiation is discussed. V. B.

458. Self-Filling Micro Infra-Red Absorption Cell. N. B. Colthup and V. Z. Williams. *Rev. sci. Instrum.*, 1947, **18** (12), 927.—The cell consists of a stainless-steel portion containing two orifices for filling, mercury–tin spacers, and salt windows with clamps. One orifice contains a bent hypodermic needle, along which solution can be siphoned for filling the cell. The total volume is 0·004 ml, and it will hold volatile liquids such as CS_2 for periods up to ½ hr. H. C. E.

459. Infra-Red Absorption Analysis of Gases and Vapours. 5. Total Radiation Analysers. R. Quarendon. *Petroleum*, Sept. 1947, **10**, 266.—The I.G. Farbenindustrie A.G. "URAS," the Russian " optic acoustical," and the Baird infra-red total-radiation analysers are described.

In the " URAS " analyser, pulsating radiation from a glowing nichrome coil passes through the test gas to one side of an energy detector and from a separate coil, through a duplicate cell containing air, to the other side of the detector. The two halves of the gas-detector cell are separated by the diaphragm of a membrane condenser. Differential heating of the two halves sets up a small alternating potential difference across the condenser, which, amplified and rectified, is used as a measure of the absorption.

Interfering secondary absorption, due to constituents other than the one being measured, is most serious for saturated hydrocarbons. The difficulty may be removed by insertion of a filter chamber in the radiation path containing a suitable mixture of the interfering gases.

Examples of analysis are given.

The " optic-acoustical " instrument has one radiation path, the energy falling on a microphone tuned to the pulsation frequency, at the far-end of the gas cell. The microphone output is amplified and measured with a galvanometer. The " Spectrophone " version uses a narrow radiation band to overcome interference.

The Baird analyser resembles the " URAS," but both beams traverse a single sample cell, then one beam passes through a filter absorbing strongly in the same region as the gas being analysed, while the other passes through a compensating filter which does not absorb in this region. The two beams then impinge on different arms of a Wheatstone-bridge bolometer. F. W. H. M.

460. Infra-Red Absorption Analysis of Gases and Vapours. 6. Additional Apparatus. R. Quarendon. *Petroleum*, Nov.–Dec. 1947, **10**, 252.—This is the last article in this series and deals with apparatus not previously described.

Four types of Baird Associates Analyser Models are briefly described. Interesting applications are the determination of butene in a stream of *iso*-butylene and of acetylene in a stream of acetyl chloride. A useful selected bibliography is appended.

F. W. H. M.

461. Photo-electric Pressure Recorders. R. Vichnievsky and G. Monnot. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 381–399.—Photo-electric cells can either amplify the movements of a mechanical indicator (*e.g.* bouncing pin) or else indicate pressure by interpreting some optical property (*e.g.* double refraction). Following a brief description of instruments of both types, a detailed discussion is presented dealing with the Labarthe photo-cathodic recorder. The principle of this method is the measurement of changes in intensity of light reflected from a polished membrane (made from Cr–Mo–W steel or beryllium bronze) fitted to the cylinder, the convexity of which varies with pressure. The reflected light impinges on a photo-electric cell, the modulated and amplified current from which is fed to a cathode-ray tube. The instrument was designed mainly for I.C. engines, giving either pressure/time or pressure/volume diagrams, but it can also be used for compressors, steam engines, and combustion bombs. Calibration methods are described and constructional details of both the electrical and mechanical portions of the apparatus are given. V. B.

462. Application of Quartz to Pressure Measurement. R. Vichnievsky and J. Gay. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 400–421.—The piezo-electric properties of quartz make it suitable for use in pressure recorders. An explanation of the physics of the phenomenon is followed by a detailed discussion of the design and construction of pressure detectors incorporating quartz and of the mechanical and thermal factors which influence their operation. Most of the detectors have hitherto been of German manufacture and typical examples of these are considered. Test methods incorporating quartz recorders and means for calibrating the latter are described. The characteristics of the electrical connexion between the quartz and the amplifier (feeding a cathode-ray oscillograph) and the circuit chosen for the latter are important factors affecting the results obtained. V. B.

463. Capacity Pressure Recorders. R. Vichnievsky, G. Monnot, and R. Guyot. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 422–437.—Capacity may be used to detect pressure changes either by means of a high-frequency Wheatstone bridge or by causing the capacity to influence the current in an amplifier or transmitter, or else by arranging for the capacity to act as a modulator in a frequency modulation circuit. The fundamentals of these methods are briefly stated, and industrial pressure recorders based on these principles are described. Particular attention is paid to the Phillips instrument, which the authors have used for determining compression diagrams on I.C. engines. V. B.

464. Recording of the Indications Displayed on Cathode-ray Tube Screens. L. Thaler and R. Vichnievsky. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 438–463.—A study of methods whereby electrical signals from various detectors and amplifiers can be recorded as a function of the crankshaft angle or of time. Such recording can be done either by using one set of plates in the cathode tube in conjunction with a moving film, or else by applying to the second set of plates a potential varying as a function of time (time-base method) and photographing the indications on a stationary film. Alternatively the variable potential on these plates may be controlled from a device operated mechanically by the engine. These methods are examined in considerable detail, including descriptions of the apparatus used, circuit diagrams, and typical results. In order to obtain the required precision in the calculation of the power from an indicator diagram thus obtained, timing of the calibration points, with reference to top dead centre, should be to an accuracy better than $\frac{1}{2}°$. V. B.

465. Stroboscopic Pressure Recorders. L. Thaler, R. Vichnievsky, and E. Broders. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 464–486.—Following on a description of an early (1878) type developed in France, details are given of various modern instruments (Bureau of Standards, Farnborough, D.V.L., General Motors). The instruments can be divided into two main classes, balanced valve and balanced diaphragm, exemplified by the Farnborough and D.V.L. patterns respectively. The authors have developed a "strobocathodic" recorder in which a stroboscopic diagram is shown on the screen of a cathode-ray tube. Vertical displacement of the spot is controlled by cylinder pressure acting on the membrane, whilst horizontal displacement varies with the crankshaft angle or piston position. This instrument is described in some detail, and diagrams obtained both with it and with other types are reproduced. The errors inherent in such instruments and calibrating methods are discussed. V. B.

466. Use of Oil-Diffusion Pumps in Mass Spectrometers. T. D. Morgan. *Rev. sci. Instrum.*, 1947, **18** (12), 926.—It is claimed that the substitution of oil-diffusion pumps for mercury-diffusion pumps decreases the time required for operation and results in greater accuracy, particularly for C_2 samples. H. C. E.

467. Research Equipment at the Perkins Works. Anon. *Gas Oil Pwr*, 1948, **43** (508), 9.—Among the research tools is a two-channel recording cathode-ray oscillograph which can be used to record pressures from 0·005 lb to 20 tons per sq. in, varying from static conditions to frequencies of 10,000 cycles/sec. Engine noises, vibration, or stress can also be recorded. Another oscillograph measures the torsional vibration of crankshafts. Other instruments include a flashing-lamp stroboscope and photo-electric smoke meters. Research is also carried out on efficient combustion in oil engines, and the amount of air consumed during combustion. H. C. E.

Crude Oil.

468. T.C.C. Processing of Pennsylvania Grade Crude Oil Fractions. N. D. Noll and D. M. Luntz. *Oil Gas J.*, 15.1.48, **46** (37), 81.—Gasoline yields and octane numbers to be realized from several different methods of thermal and catalytic processing of Pennsylvanian light crude-oil fractions are compared.

The crude taken as the basis contains 25% light straight-run gasoline, 10% heavy naphtha, and 20% light gas oil. Tables give inspection of the typical crude-oil fractions, typical data for T.C.C. cracking of the fractions, and outline of processing methods. Two charts show volume per cent 10 lb gasoline—based on straight-run gas oil and lighter. G. A. C.

Engine Fuels.

469. Relationship Between the Engine and its Fuel in the Light of the Latest Road Test Methods. M. Pierlot. *Bull. Ass. franç. Tech. Pétrol.*, 1947, (66), 1-22.—A lecture reviewing recent American work in this field. V. B.

470. Bench and Road Test Rating of Automobile Fuels. M. Thaler. *Bull. Ass. franç. Tech. Pétrol.*, 1947, (66), 23–25.—A note giving (graphically) some preliminary results on tests of three fuel mixtures on an 11-h.p. Citroen by the borderline knock-curve method. V. B.

471. Cutting Aircraft Engine Maintenance Costs. E. A. Droegmueller. *A.S.T.M. Bull.*, Oct. 1947, **148**, 79–86.—The results of tests made at Pratt and Whitney Aircraft on the effect of fuel properties on maintenance problems are discussed, and results of excessive lead, fuel residuals, induction system deposits, and operating limits on engine reliability are evaluated. J. G. H.

472. Jet Fuels for Aircraft. H. A. Murray. *Oil Gas J.*, 8.1.48, **46** (36), 53.—Pertinent fuel requirements of the more popular jet engines are dealt with.

Volatility affects ease of starting, combustion efficiency, deposits in engines, vapour locks, evaporation losses, and fire hazard. Composition (carbon–hydrogen ratio) influences combustion efficiency, smoke, and deposits; paraffins heading preference list.

Regarding stability much remains to be learnt in connexion with gum tests. The requirement of very low freezing point will have a marked effect on selection of jet fuels. As for heating value, the criterion is becoming B.Th.U/gal and not per lb; and range of aircraft depends on heating value

It is not expected that jet engines can utilize heavy distillate fuels such as diesel and gas oils because of low temperatures met with.

Seven figures and two tables are given. G. A. C.

473. Octane Number Development of Fuels Destined for French Automobiles. W. F. Taylor. *Bull. Ass. franç. Tech. Pétrol.*, 1947, (66), 27–33.—A lecture. It is suggested that, for European manufacturers limited in the O.N. range of available fuels, a combination of relatively low C.R. with supercharging may be advantageous. V. B.

474. Oil Reclaiming. Anon. *Diesel Pwr Diesel Transportation*, Nov. 1947, **25** (11) 60.—A new portable, self-contained oil-conditioner unit, having capacities from 50 to 600 gal/hr, has been developed by the U.S. Hoffman Machinery Corporation. The conditioner is a combination of a cartridge filter and a vaporizer; the former (of either a repackable or a throwaway type) removes insoluble material and acid contamination from the oil by means of fuller's earth or bauxite, while the latter removes fuel dilution, undissolved gases, water, etc. The vaporizer can be used independently of the filter if necessary. C. D. B.

475. Frigid Starting and Operation. E. W. Goodale. *Diesel Pwr Diesel Transportation*, Nov. 1947, **25** (11), 49.—When starting engines at sub-zero temperatures, the author experienced trouble with fuels having high cloud and pour points, owing to the solidification of wax in the fuel. At intermediate atmospheric temperatures,

easier starting was obtained with high cetane-number fuels, but as this range of temperature was comparatively narrow, the cetane value was found to be of minor importance at frigid temperatures. Adequately low cloud and pour points were the most important necessities.

Another problem encountered was the formation of ice in the fuel, due to the small quantity of water which it always contained. This difficulty was overcome by the addition of an ice preventative to the fuel. With regard to the lubricating oil, it was not advisable to reduce the viscosity much below that recommended by the engine manufacturers, and hence artificial means, such as heaters, were adopted to keep the oil warm when the engine was not in use.

Easier starting was also made possible by the injection of a starting fluid into the intake manifold by means of a primer system. The chief advantage of this fluid was the fact that it had a seven-fold wider range of inflammability than pure hydrocarbons.

Besides the above specialized petroleum products, many types of engine heaters have been developed as additional aids to cold starting. C. D. B.

Gas Oil and Fuel Oil.

476. Gaseous and Liquid Fuels in Iron and Steel Works. Engineering Aspects of Distribution and Utilization. J. B. R. Brooke and J. S. Bryan. *J. Iron. & Steel Inst.*, Jan. 1948, **158**, 111.—The paper describes a North Lincolnshire steelworks of 35 years operation. A description is given of the existing system of blast-furnace gas distribution. Cleaning is accomplished in two stages, the first at each furnace, comprising dust-catcher, water towers, and separators, the final stage consisting of Cockerill and Thiesin washers feeding the ovens and power house. Gas is held in a 2,000,000 cu. ft. capacity holder. Gas mains are of steel riveted or welded plates.

Steam connexions are provided for purging, and isolation valves installed. Distribution of coke-oven gas follows in principle that of clean blast-furnace gas. Liquid fuel is also used, and provision made to hold the stored fuel at correct pumping temperature, creosote–pitch and heavy Pool fuel oil being the oils consumed.

The fuel-control room is fitted with the normal instruments. Fuel is utilized for underfiring ovens and power production, and burners were designed and manufactured at the works and are still being further developed. G. A. C.

Lubricants.

477. Short Cycle Batch Operation in Grease Manufacturing. C. L. Johnson. *Petrol. Process.*, Jan. 1948, **3** (1), 57–64.—Most grease plants at present operate 24 hr a day for 6 or 7 days a week, necessitating a large number of trained supervisors, and often resulting in lack of accurate control. A feasible alternative is to operate on an 8-hr-day–5-day-week basis, provided additions are made to equipment, and strict control regulations laid down. Raw materials must be accurately evaluated in advance.

The equipment needed to convert existing plant to short-cycle batch operation includes: (1) equipment for weighing; (2) adequate pressure saponification mixing equipment; (3) fast high-temperature heating means.

Oil may be circulated instead of steam as a heating medium in compounding operations, and the method is discussed.

A typical process cycle for a No. 1 Soda Fibre grease is described, and is illustrated by a flow sheet and diagram of the oil-circulation heating system. W. M. H.

478. Rapid Methods of Grease Analysis. Anon. *A.S.T.M. Bull.*, Oct. 1947, **148**, 73–78.—A description is given of procedures in rapid methods of grease analysis, particularly adaptable to control purposes, although possibly not sufficiently accurate for reference work. Procedures described comprise: (1) determination of oil in lubricating greases; a qualitative method for the separation of mineral oils for the purpose of obtaining tests on the mineral oil component; (2) Swan–Finch control method for the determination of soap content, filler content, and mineral-oil viscosity; (3) General Electric Co. soap determination in grease; (4) Sinclair method of routine analysis as applied to driving journal and rod cup greases; (5) determination of sodium soap in greases known to contain only sodium soap and no interfering fillers. J. G. H.

479. Microworker for Lubricating Greases. G. M. Hain. *A.S.T.M. Bull.*, Aug. 1947, **147**, 86–88.—A new instrument for mechanically working 5 g samples of lubricating greases and for measuring the consistency of these greases at any stage of the working process consists of two 5 cc hypodermic syringes connected together tip to tip through a shearing element. A normal micropenetrometer needle with a novel grease-holding cup enables results to be obtained on most greases in about 10 min as opposed to 24 hr for the 100,000-stroke test in a standard A.S.T.M. worker. J. G. H.

480. Micro Penetration of Lubricating Grease. Anon. *A.S.T.M. Bull.*, Aug. 1947, **147**, 81–85.—A method of obtaining penetrations of small samples of grease of the order of 4 g is discussed which utilizes the present A.S.T.M. penetrometer together with a simply constructed grease holder and an aluminium plunger and cone, and gives results of reasonable reproducibility. The corrrelation between A.S.T.M. penetrometer values and results by the micro penetrometer is given, together with procedures for the measurement of penetration of worked and unworked lubricating greases. J. G. H.

481. Synthetic Lubricants. Anon. *Petroleum*, Oct. 1947, **10**, 237. (*Abstract from a paper by* J. M. Russ, Jr., *presented to the American Society of Lubrication Engineers.*)—The Carbide and Carbon Chemicals Corporation has recently produced two series of synthetic lubricants, one being water-insoluble, the other soluble. Raw materials are natural or other hydrocarbon gases.

Those insoluble in water are designated LB followed by the viscosity at 100° F in S.S.U. The soluble series is designated 50-HB and the viscosity number. Viscosity can be controlled in the manufacturing process.

Blending is unnecessary and high viscosity indices and very low pour points are inherent. Grading into SAE Viscosity grades is difficult owing to the viscosity–temperature relationship.

Tables showing the properties of five grades of each series are given.

Low carbon residues are characteristic, the oxidation products are mostly low-molecular-weight volatile compounds. Insoluble oxidation products are not formed.

The LB series is soluble to a limited extent in petroleum oils at ordinary temperatures, and quite soluble at elevated temperatures. It is soluble in petrol and kerosine. The 50-HB series is less soluble in petroleum oils, and dissolves most oxidation products of petroleum lubricants and fuels. Both series have little or no effect on rubbers.

The LB series is best suited to the lubrication of general machinery including internal-combustion engines. It is claimed that LB-300 has given excellent service in commercial road vehicles. A list of benefits stated to result from its use are given, those of most significance being minimal engine deposits and the fact that oil changes are dependent on dilution rather than oil deterioration.

It is pointed out that with these products many of the chemical tests applied to petroleum oils lose their significance and examples are cited to show this. It is suggested that viscosity, ash, free and total acid tests would be most useful for used synthetic oils.

A comprehensive range of industrial uses of the oils is given together with examples of their successful application.

Greases have been made only experimentally. F. W. H. M.

482. Gear and Lubricant Tester Measures Tooth Strength or Surface Effects. E. A. Ryder. *A.S.T.M. Bull.* Oct. 1947, **148**, 69–73.—Methods of gear research, nature of gear failures, and current equipment for bench testing are discussed in an introduction. The Pratt and Whitney gear-test rig here described uses as test specimens a pair of gears similar to those used in an actual engine, but of simple manufacture. The various factors affecting the load capacity of gearing are studied separately. The load on the test gears can be changed without stopping the machine; lubrication of the test gears is controlled separately from that of the rest of the rig. J. G. H.

Bitumen, Asphalt, and Tar.

483. National Asphaltic Products from the Talara Oilfields. R. Q. Salinas and C. R. Melgar. *Inf. y Mem. Ing.* (*Peru*), 1947, **48**, 119–129.—International Petroleum Co.

have been producing cracked bitumens from waxy Peruvian crude oil at their Talara refinery for a number of years. Specifications of the materials used for roads and paving are given; the powdered asphalt has 92·5% passing 40 mesh, zero penetration, and 250–275° F softening point. The authors are satisfied that, where road failures in Peru have occurred, the asphalt has not been at fault. A. C.

Special Hydrocarbon Products.

484. Toxicities of Three Petroleum Oils to the Grain Weevils. P. S. Hewlett. *Ann. appl. Biol.*, Dec. 1947, **34**, 575–585.—Shell oil P.31, Odourless Distillate (O.D.), and Pool Burning Oil (P.B.O.) have been used against *Calandra granaria* and *C. oryzæ*. The relative toxicities to both species of direct sprays of the three oils could be expressed as: P.B.O.<P.31>O.D.>P.B.O.

Films of P.31 on brick, sacking, and cement were non-toxic to *C. granaria*, but proved highly toxic on cement pre-treated with gelatin.

Insects which received doses of P.31 slightly in excess of the knock-down dosage rarely recovered completely, and it is thought that the effect of the P.31 was to block the spiracles and tracheæ and so cause suffocation. For *C. granaria*, best results were given by P.31. This should be effective as a direct spray, but not as a film, though films on pre-treated surfaces might be used for control.

Four text-figures and twelve literature references are included. W. M. H.

485. D.D.T. Preparations to Control Certain Scale Insects on Citrus. W. Ebeling. *J. Econ. Ent.*, Oct. 1947, **40** (5), 619–632.—Results are presented of experiments made in fourteen orange and lemon orchards in seven Californian counties. The solutions used consisted of D.D.T. dissolved in: (1) light mineral spray oil; (2) mineral seal oil; (3) kerosine, to produce concentrations of 4·7%-wt D.D.T. and 9·4%-wt D.D.T.

It was found that, where only one application per year was given, the light spray oil plus D.D.T. gave on the whole better results than D.D.T. alone, but kerosine alone proved superior to kerosine containing D.D.T. Where two treatments were applied, the second following the first by about two months, D.D.T. in kerosine proved far superior to oil alone. D.D.T. is, however, not as effective against yellow as against red scale.

The use of D.D.T. in kerosine does not appear to have any adverse effect on the fruit, and does not increase the incidence of water spot, though the prevalence of this malady is greatly increased by regular oil sprays.

In another series of experiments, di-2-ethyl hexyl phthalate was used with D.D.T. instead of an oil spray, but proved generally inferior to petroleum.

Seven literature references are given. W. M. H.

Derived Chemical Products.

486. Petroleum Chemicals Reviewed. (3) Butadiene and (4) New Petroleum Chemicals. R. F. Goldstein. *Petrol. Times*, 3.1.48, **52**, 19.—Statistics of the production of butadiene by two methods, based respectively on alcohol and petroleum, are given for the years 1942–45. Developments in the processes of manufacture are given. Ten references are appended.

Glyoxal and thiophene are now commercially prepared from petroleum. The applications and preparation of these chemicals are described. Three references are appended. C. G. W.

Miscellaneous Products.

487. Petroleum, Basic Raw Material for Surface Coatings. R. F. Ruthruff. *Petrol. Process.*, Jan. 1948, **3** (1), 21–24.—Petroleum is becoming increasingly important in the manufacture of resins, solvents, drying oils, and other materials used in surface coatings. Reactions are described by which the intermediates for polyhydric alcohol–polycarboxylic acid can be obtained from hydrocarbons. One important development is the use of ortho-xylene, from aromatized paraffinic naphthas, in the preparation of phthalic anhydride, an intermediate for alkyd resins. Naphthalene was formerly the principal charging stock, and this is in very short supply. In the near future it may

also be possible to synthesize drying or semi-drying oil fatty acids from a Fischer–Tropsch petroleum oil. W. M. H.

488. Rust Preventives. How They Work, What They Contain. H. Sellei. *Chem. Ind.*, Jan. 1948, **60** (1), 62.—A review of rust-preventive coatings of a temporary character is given. Corrosion phenomena are the result of electro-chemical reactions, the exposed metal developing points of different potential, producing local electric currents.

The application of an impervious tightly adherent coating to the metal surface will eliminate corrosion. Protection methods include wrapping, layers of petrolatum, natural and synthetic resins. Recent experiences have led to new specifications and formulations. "Polar" compounds are examples of new products. Fumaric or maleic acid esters and their derivatives have been patented as rust preventives.

Oil-type corrosion preventives find general application as instrument oils, coats for steel bars; and grease-type coatings are used for inside and outside storage.

Pigments are also incorporated.

A need exists for correlation of laboratory tests and actual service conditions. A table lists some U.S. Government specifications for temporary rust-preventive coatings. Forty-two references to the literature are made. G. A. C.

Engines and Automotive Equipment.

489. Blackburn Cirrus. J. Oates. *Airc. Prod.*, Dec. 1947, **9** (110), 449.—These engines are of the inverted 4-cylinder in-line type and are finding application in post-war light transport and passenger types of aircraft. Some aspects of the production of Series II and Series III engines are reviewed in the article. I. G. B.

490. Latest Bristol Piston Engines. Anon. *Flight*, 8.1.48, **53** (2037), 32.—Some details are given of the civil Hercules and Centaurus series involving high take-off power and low consumption. I. G. B.

491. Improved Fuel Injection (B.P. 587276). F. Perkins, Ltd., and W. Spoor. *Gas Oil Pwr*, 1948, **43** (509), 52.—Air is introduced into the cylinder tangentially, an annular combustion chamber is located in the piston, and fuel is injected transversely to the air thereby setting up a swirl in the cylinder during the inlet stroke. (Four figures.) H. C. E.

492. Diesel Developments of Significance. C. G. A. Rosen. *Gas Oil Pwr*, 1947, **42** (507), 410.—The progress of the diesel engine from 1910 onwards is shown by figures of output per cu. in of piston displacement and wt per b.h.p. Improvements in methods of stress analysis and fatigue studies will produce engines of even better performance in the future. Lubricants, the function of which is also that of cooling agents, oxidation resistors, and scavenging agents are of assistance in improving diesel engines, but a problem still remaining is concerned with the use of high-sulphur fuels, which introduce the possibility of serious corrosion. H. C. E.

493. American Radial Air-Cooled [Diesel] Engine. Anon. *Gas Oil Pwr*, 1948, **43** (509), 42–44.—The Caterpillar diesel military engine is a radial type single-row 9-cylinder air-cooled engine operating on a 4-stroke cycle. The cylinders are 6½-in bore by 6¾-in stroke with a compression ratio of 15½ : 1, and the unit develops 450 b.h.p. at a maximum speed of 2000 r.p.m.

The fuel passes through a pre-combustion chamber to mix the fuel thoroughly with the air, with the result that the unit will operate on fuels varying from crude oil to 72-octane gasoline. Heat is dissipated by spraying lubricant on the under side of the piston heads, and in addition a cooling fan and air-directing shroud enables air to be forced past the cylinder fins. The oil after circulation to the engine parts is returned to the sump via an air-cooled radiator placed immediately in front of the fan. H. C. E.

494. Development in Diesel Engines. H. Pyk. *Motor Ship*, 1947, **28** (35), 340.—Particulars are given of the development of the Polar engine from its inception nearly 50 years ago, and the author shows how the present-day design has been reached as a result of experience of many types of engine. Particulars are included of the latest supercharged 2-stroke engine. I. G. B.

495. British Main-Line Diesel Locomotive. Anon. *Gas Oil Pwr*, 1948, **43** (508), 3–7.—This locomotive, the first of its kind in Great Britain, was built by the L.M.S. Railway Co. and English Electric Co. Ltd., for express passenger service. The oil engine is of the English Electric 16SVT type, pressure-charged on Buchi principles, and having a B.S.I. 12-hr rating of 1600 b.h.p. at 750 r.p.m. The 16 cylinders have 10-in bore by 12-in stroke, and the average fuel consumption is 0·375 lb/b.h.p.hr.

A general description of the locomotive is given under the following headings: engine structure, engine auxiliaries, pressure charging, cooling fuel and air systems, electrical equipment, electrical auxiliaries, mechanical portion, and bogies. A line drawing and 3 photographs are included. H. C. E.

496. New Low-Power British Diesel. Anon. *Gas Oil Pwr*, 1948, **43** (508), 24–27.—These Petter vertical engines have one or two cylinders of 80 mm bore and 110 mm stroke with a b.m.p. of 78 p.s.i. The single-cylinder unit, weighing 320 lb, has an output of up to 5 b.h.p. at 1500 r.p.m., and the twin-cylinder unit, weighing 455 lb, up to 10 b.h.p. at 1500 r.p.m.

The combustion-chamber design provides a high degree of turbulence to give a clear exhaust at all loads and speeds. Fuel consumption varies from 0·43 to 0·53 lb/b.h.p.hr. at full load and half load respectively at 1500 r.p.m. A pressure pump, driven from the crankshaft, delivers oil to the main and crankpin bearings and valve rockers; liners, camshaft, and top-end bushes are splash lubricated. Lubricating-oil consumption at full load and 1500 r.p.m. is 0·006 lb/b.h.p.hr. The text is illustrated by ten line drawings. H. C. E.

497. Opposed-Piston Engine History. W. K. Wilson. *Gas Oil Pwr*, 1947, **42** (506), 388–394.—A review of mechanisms employing opposed pistons, from the Wittig gas engine of 1878 to the Doxford marine oil engine of 1926. H. C. E.

498. Fullagar Opposed-Piston Engine. B. Reed. *Gas Oil Pwr*, 1948, **43** (509), 35–41.—The engine is a two-stroke opposed-piston crosshead model with the lower piston of one cylinder connected by diagonal tie rods to the upper piston of the adjacent cylinder. Each connected pair drives on one throw of the crankshaft, and adjacent throws are set at 180° to each other. This design has the advantages that: (1) in multicylinder models the turning moment is very uniform; (2) work done in compressing the charge in one cylinder is transmitted through the tie rods without the forces passing through the crankshaft; and (3) the reciprocating masses are well balanced. The inlet and exhaust ports are operated by the pistons.

Mechanical construction of the engine frame, pistons, crossheads, diagonal rods, connecting rods, crankshaft, flywheel, and camshaft are described.

A separate C.A.V. fuel-injection pump, supplying two opposed nozzles in the centre of the liner, is provided for each cylinder. The injectors are set to lift at 2000 p.s.i., and are indirectly water cooled. Lubricating oil is supplied at 25 p.s.i. by a gear-type pump to the cooling system, in which oil is piped to the undersides of the piston crowns, and leaves through sight glasses where the flow can be controlled and the temperature observed. Main lubrication at 15 p.s.i. is through a circuit in which oil is piped to the big-end bearings, crosshead guide plates, and main and oblique connecting-rod faces. 1200 gal oil are in circulation at the rate of 300 gal/hr, and the consumption is 10 pt/hr.

The text is illustrated by 7 figures and diagrams. H. C. E.

499. Up-to-Date Meadows Marine Engine. Anon. *Gas Oil Pwr*, 1948, **43** (508), 23.—The engine comprises 6 cylinders, each of 130 mm bore and 130 mm stroke, giving a top output of 130 b.h.p. at 1900 r.p.m., with a corresponding b.m.p. of 86 p.s.i. The continuous cruising rating is 95 b.h.p. at 1700 r.p.m. Optimum fuel consumption is 0·355 lb at 1300 r.p.m. and b.m.p. of 75 p.s.i. Fuel injection, through C.A.V. or Simms

equipment, is directed into a plain combustion chamber and burned at a compression ratio of 16 : 1. Lubrication throughout is by a gear-type oil pump, and full-flow filters are incorporated. Cooling is effected by fresh water in a closed circuit with a heat exchanger at the forward end of the engine. H. C. E.

500. AEC Stationary Engine. Anon. *Gas Oil Pwr*, 1947, **42** (507), 403–409.—The specifications of this unit include: six 120 mm by 142 mm cylinders giving a continuous output of 100 b.h.p. at 1500 r.p.m., corresponding to a b.m.p. of 90 p.s.i., specific fuel consumption 0·382 lb/b.h.p.hr. Cylinders are fitted with Ricardo swirl chambers. The engine is described under the headings: torsional vibration, engine block, cylinder heads and liners, crankshaft, bearings, moving parts, and electrical equipment.

Lubrication is on the wet-sump principle from a 14 gal sump. Oil is fed from a gear-type pump to the main bearings, and thence to the big ends and timing gears. The camshaft bearings are splash-lubricated. An auxiliary pump provides circulation through a filter and oil-cooling chambers at the rate of 400 gal/hr. Radiator cooling is fitted, and water is circulated at the rate of 15 gal/min. H. C. E.

501. Fundamentals of the New Jet Motors. G. J. Sleutelberg. *Ingenieur*, 6.2.48, (6), O13–16.—The article is in two sections: (1) Gas turbines and jet motors; (2) Rockets and Rocket-propelled missiles.

Full descriptions and diagrams of the following combustion chambers are given: (*a*) Power Jets Ltd's PJ/102; (*b*) Joseph Lucas Ltd's B37; (*c*) Metropolitan Vickers Ltd's F3. N. C.

502. Fundamentals of the New Jet Engines. D. Dresden. *Ingenieur*, 16.1.48, O1–4.—The history of jet engines is traced from the Wilkins gas turbine (year 1680) to the 27,000 K.W. B.B.C. gas turbine of 1940. Nine diagrams of schematic gas-turbine installations, including one of the V2, are included. N. C.

503. The T-Scheme. P. F. Ashwood. *Flight*, 4.12.47, **52**, 630.—The result represents a long series of investigations of experiments and tests on a low-loss combustion system for aircraft gas-turbine units. Criteria involved are described, and diagrams show the flow pattern in an experimental chamber used for initial tests, the T-scheme chamber originally designed, and the flow pattern in a developed chamber. On a basis of combustion intensity the loss factor is plotted for various types of chambers and the advantage of the T-scheme is pronounced. I. G. B.

504. Alloys for Gas Turbines. Sir W. Griffiths. *Aircr. Prod.*, Dec. 1947, **9** (110), 444.—Observations are made on the criteria for fatigue and corrosion resistance, also ease of fabrication of blade, rotor, discs, guide vane, and combustion-chamber materials. I. G. B.

505. Gas Turbine Locomotives for Great Britain. Anon. *Ingenieur*, 6.2.48, (6), V20.—An order has been placed by the G.W.R. with the Brown Boveri Co., Baden, for a gas-turbine locomotive weighing 117 tons and capable of 90 miles/hr. A detailed drawing of the locomotive is included. N. C.

506. New U.S. Gas-Turbine Designs. Anon. *Flight*, 5.2.48, **53**, 142.—Details are given of the Jharl 6000-XA turbo-jet and Flader XT-33 air-screw turbine. The former employs a compression ratio of 6 : 1 with contraflow combustion chambers while the turbine and compressor are connected by a planetary reduction gear. The latter is a 7500 s.h.p. unit. I. G. B.

507. Study of Piston Ring Reasoning and Design. Part 2. Anon. *Diesel Pwr Diesel Transportation*, Nov. 1947, **25** (11), 75.—The advantages of the sealing-type compression ring over the plain-type ring are mainly derived from its ability to prevent blow-by when the cylinder bore becomes worn. The reduction in exhaust-gas temperature by the use of sealing rings will also reduce cylinder wear and maintenance expense owing to the more ideal lubrication which is effected where lower temperatures prevail.

In addition, by decreasing blow-by and engine temperatures, the rate of lubricating oil deterioration is slowed up.

Since the pistons rings are the principal agents in the transmission of excess heat from the piston to the cylinder walls, it follows that sealing rings, with their ability to reduce blow-by and thus maintain the oil film between the rings and the bore, will increase the operating life of the piston. Piston-groove wear is correspondingly reduced with the reduction of cylinder wear, since this wear is believed to be caused by the oscillating movement of the rings in following the contour of a worn cylinder. It was also found that easier engine starting was obtained when sealing rings were used.

It is emphasized that the conclusions drawn apply specifically to the test engine used, and that other results may be obtained from a different type of engine.

C. D. B.

508. Recent Improvements in Steam Turbine Oils. C. G. Verver. *Ingenieur*, 16.1.48, Mk. 1–7.—Sludges formed when turbine oils are oxidized at high temperatures consist of either high-molecular-weight polymerized bodies or of acidic compounds, containing organic acids, oxy-acids, and lactones.

Sludging difficulties have been overcome by new refining techniques producing non-sludging oils by acid and earth treatment of selected raffinates. The introduction of doped turbine oils has increased the life of turbine oils to 60,000 hr; one oil (Shell Turbo 27) showing an acid value of 0·1 after 62,000 hr of continuous service.

A new turbine-oil test evolved by the Shell Oil Co. and developed by the B.P.M. laboratories is fully described. Thirteen charts and graphs are included in the article.

N. C.

509. New Indentation Method Determines Equipment Wear. Anon. *World Oil*, Oct. 1947, **127** (6), 104.—Investigations conducted at the National Bureau of Standards have led to the adaptation of a diamond indentation method of measuring wear. A sensitive instrument, known as the McKee Wear Gauge, was developed to measure extremely small increments of wear. The method consisted of applying to the working surfaces several narrow diamond-shaped markings, which were found to show a definite change in one or more readily measurable dimensions after relatively small amounts of wear; these measurements could be correlated with actual wear. The McKee gauge was designed primarily to locate and measure indentation marks on the cylinder walls and pistons of radial aircraft engines, but a similar instrument has been designed for use with automobile engines in which the cylinders are cast into a single engine block. Under favourable circumstances these instruments can measure small increments of wear of the order of 0·00001 in.

The instrument has been used to study the wear in stock passenger-car engines under controlled conditions. These studies have shown that: (1) a greater amount of wear occurs when starting the engine at low temperatures than at high temperatures; and (2) corrosion caused by moisture condensing on the cylinder walls and absorbing gases from the products of combustion to form corrosive acids may be responsible, for a major part of the wear occurring in the normal operation of an engine.

R. B. S.

MISCELLANEOUS.

510. Aluminium Stearate Gels for Use as Flame-Thrower Fuels. C. M. Cawley, J. H. G. Carlile, J. G. King, and F. E. T. Kingman. *J. Inst. Petrol.*, 1947, **33**, 721.—An account is given of the work at the Fuel Research Station (D.S.I.R.) concerning the invention and development up to full-scale manufacture of flame-thrower fuels consisting of aluminium-stearate gels in petrol peptized with cresylic acid or mixed xylenols.

Descriptions are given of the investigation and control of the manufacture of the aluminium stearate, and the results of studies of the effects of peptizers and of various grades of petrol are recorded. Manufacture was developed at the Fuel Research

Station to a stage where a mobile mixing plant (750 gal) was designed, built, and operated.

Studies of the following physical and chemical properties of the fuels are described: (*a*) anomalous viscosity; (*b*) variation of viscosity with temperature ("temperature sensitivity"); (*c*) stability of gels on storage at various temperatures.

Although the service fuel was highly satisfactory, attempts were made to effect improvements, mainly by the use of peptizing agents other than xylenols. Thus it was shown that the lower aliphatic alcohols decreased the temperature sensitivity of the fuels, while a considerable economy in the amount of aluminium stearate required, together with increased stability at high temperatures, was effected by the use of ethyl cellosolve as a peptizing agent. The latter compound was of particular promise. Certain desirable properties of the gels, however, appeared to be conferred on them only by xylenols, and it is probable that mixtures of the peptizing agents, chosen according to the properties required in the fuel, would afford the best solution to the problem of producing improved flame-thrower fuels. A. R. W. B.

511. Metallurgical Methods for Combating Corrosion and Abrasion in the Petroleum Industry. B. B. Morton. *J. Inst. Petrol.*, 1948, **34**, 1–59.—A review of steps that have been taken within the petroleum industry in the U.S.A. to counteract destruction of equipment by corrosion and also an outline of recent metallurgical developments within the industry.

Corrosion problems in exploration, drilling, pumping, transportation, and the whole gamut of refinery operations are discussed, suggestions are made as to the best practice, and many tables on corrosion data of alloys in specific operations are given.
A. R. W. B.

512. What Does Industry Have a Right to Expect of Petroleum Engineering Schools? P. H. Bohart. *Petrol. Tech.*, Nov. 1947, **10** (6), *A.I.M.M.E. Tech. Pub. No.* 227, 1–6.—2000–3000 petroleum engineers are entering industry yearly, and management is being entrusted more and more to technically trained executives. Industry therefore expects the petroleum engineering schools to provide a broad basic training and a social and economic outlook beyond the minimum technical qualifications needed to discharge the responsibilities of a particular job. Training in fundamentals is essential as well as in other branches of engineering, and the engineer must be able to arrange and write a sound report. He should speak well.

A five-year course may be needed. A standard of ethics should be set. There should be a desire to arrive at the truth, and the ability to lead should be stressed.
G. D. H.

513. National Petroleum and Motor Fuels. E. Zedet. *Bull. Ass. franç. Tech. Pétrol.*, 1947, (66), 35–79.—A discussion of crude-oil and motor-fuel problems as they affect France, with special reference to dollar exchange and currency. The economics of alternative fuels (coal, lignite, peat, wood) are considered. These can, however, only be complementary to petroleum and attention should be devoted to up-grading natural carboniferous materials by chemical processes (*e.g.* methanol synthesis), thereby also providing an emergency source of motor fuel. V. B.

514. U.S.A. Lub. Oil Capacity. A. L. Foster. *Oil Gas J.*, 5.2.48, **46** (40), 78.—As a result of a company-to-company survey of lub.-oil plants in the U.S.A., total capacity for finished lub. oils of all types is given as approximately 15,000 b.d.

Tables show location, capacities, and refining processes in operation and under construction, U.S. production of lub. oils 1941–46, output capacity of lub.-oil solvent processing units and average distribution, and consumption of lub. oils in the various S.A.E. classification grades. G. A. C.

515. Fuel Oils and American Railways. J. H. Reif. *Chim. et Ind.*, 1948, **59**, 183–185.—A brief statistical summary (quoted from data published by the Interstate Commerce Commission) showing the uses of various sources of power on U.S. railways.

In 1945–46, whilst 70% of the fuel expenditure was on coal, 21% was for fuel oil for steam locomotives, and 5% for diesel fuel. V. B.

516. Price of Bunker Oil for the Past and Future. Anon. *Motor Ship*, Feb. 1948, **28** (337), 422.—Various increases announced in January 1948 and the corresponding prices per ton of different bunker fuels are tabulated. I. G. B.

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Oilfield Exploration and Exploitation.

Geology.

517. 71·3 Billion Brl Constitute Total Proven Reserves of World. W. W. Burns. *Oil Gas J.*, 29.1.48, **46** (39), 197.—Proven world oil reserves were placed at 71,312,000,000 brl at the beginning of 1948.

23,737,000,000 brl was in the U.S.A., 10,975,000,000 brl elsewhere in the western hemisphere, and 36,600,000,000 brl in the eastern hemisphere.

The U.S. reserves were 12·8 times the 1947 output. For the rest of the western hemisphere the ratio was 19, and for the eastern hemisphere 51. The ratio was 91 for the Persian Gulf area.

A table gives the crude-oil reserves by countries. G. D. H.

518. Total Liquid Proven Reserves Hit nearly 26 Billion Brl. C. J. Deegan. *Oil Gas J.*, 29.1.48, **46** (39), 170.—U.S. oil reserves as crude, condensate, and other natural-gas liquids amounted to 25,984,000,000 brl at the beginning of 1948, and the gas reserves were 174,300,000,000,000 cu. ft. Crude plus condensate total 23,737,000,000 brl.

Tables show the make-up of the liquid hydrocarbon reserves and the natural-gas reserves by States, and the ratio of reserves to annual production. The reserve contributions from 1947 discoveries, and extensions and revisions are shown. G. D. H.

519. New Reserves. Anon. *Oil Gas J.*, 29.1.48, **46** (39), 200.—New pays, new discoveries, and extensions to oilfields in the U.S.A. are listed by States, with the producing formation, proven acreage, formation thickness, and estimated reserves. G. D. H.

520. Field Name, County, Location and Initial Production of Discovery Wells. Anon. *Oil Gas J.*, 29.1.48, **46** (39), 228.—The 1947 discovery wells are listed with the location, producing depth, producing sand, oil gravity, production rate, etc. G. D. H.

521. Wilcox (Eocene) Stratigraphy, a Key to Production. D. J. Echols and D. S. Malkin. *Bull Amer. Ass. Petrol. Geol.*, 1948, **32**, 11–33.—Wilcox (Eocene) sedimentation, stratigraphy, and production are discussed and present productive trends are explained by interpreting the regional deltaic sedimentation and stratigraphical history. The near-shore sedimentary conditions at the close of Wilcox time are shown graphically by a restored strike section from eastern Alabama to southwest Texas. Data and information are taken entirely from published sources. E. N. T.

522. Permian Stratigraphy and Structure, Northern Canelo Hills, Arizona. J. H. Feth. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 82–108.—Sections measured in the northern Canelo Hills show 2223 ft of Middle Permian (Snyder Hill) limestones, dolomites, and clastics overthrust upon two distinct series of younger rocks: redbeds and brown conglomerates and sandstones, probably Cretaceous; and lava flows and interbedded tuffs and sandstones (Tertiary). Major structural events discovered are discussed. E. N. T.

523. Genesis and Evolution of Los Angeles Basin, California. H. L. Driver. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 109–125.—The oil deposits of the Los Angeles Basin are for the most part in beds of Lower Pliocene and Upper Miocene age. Local

accumulations also occur in beds of Upper Pliocene age, in the Middle Miocene, and in weathered or fractured schists of the basement complex.

The stratigraphic section shows rocks which range in age from Jurassic to Recent. The basement complex consists of metamorphic and granitic rocks. Upper Cretaceous and Eocene sediments are found in the Santa Ana and Santa Monica Mountains areas. Redbeds ranging in age from Middle Miocene to Oligocene are widespread. Igneous activity was pronounced in the Middle Miocene period. Upper Miocene sediments are the most extensive of the marine deposits. Lower Pliocene sediments were deposited in deeper water. Upper Pliocene and Lower Pleistocene sediments are extensive, and were deposited in shallower water and in conditions of marginal oscillations which have resulted in only limited phases of these deposits being present at the edge of the Basin. E. N. T.

524. Powell's Lake Oilfield, Union County, Kentucky. W. L. Ingham. *Bull. Amer. Assoc. Petrol. Geol.*, 1948, **32**, 34–51.—The discovery well of the Powell's Lake Oilfield was drilled in July 1944. It reached a depth of 2281 ft in the Cypress sand, which contained salt water and a trace of oil. The well was plugged back to Waltersburg sand at 1811–1824 ft and completed in August 1944, initially producing 84 b.d.

The two principal producing sands in the field are the Mansfield sand of Pennsylvanian age found at 1200 ft and the Waltersburg sand of Mississippian age at about 1810 ft. 25 producing wells have been completed in the field and more than half are dual producers.

Average daily production from the 25 producing wells in the field for March 1947, was 755 brl of oil. Cumulative production of the field to April 1947, was 489,865 brl of oil. E. N. T.

525. Jurassic Overlap in Western New Mexico. C. Silver. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 68–81.—Southward changes in Jurassic stratigraphy along the east side of the Cebolleta Mesa shows the nature of the southern margin of Jurassic deposition in western New Mexico. Results of the measurement of 9 sections are shown graphically. The Wingate sandstone is divided into 3 members and the Morrison formation into 4. These members thin and become coarser southward and progressively overlap a positive area in that direction. E. N. T.

526. Elk Basin Anticline, Park County, Wyoming, and Carbon County, Montana. W. S. McCabe. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 52–67.—The Elk Basin anticline is a northwest-southeast asymetrical anticline approximately 8 miles long and 4 miles wide with approximately 5000 ft of closure.

The crest of the structure is a topographic basin and the oldest formation exposed on the crest of the structure is the Niobrara shale of the Colorado group of Upper Cretaceous age. A complete section from the Fort Union Paleocene through Lance, Lennep, Bearpaw, Judith River, Claggett, Eagle, and Telegraph Creek formations of the Montana group of Upper Cretaceous age to the Niobrara shale of the Upper Colorado group is exposed on the flanks of the structure.

The discovery well in 1915 was completed in the First Frontier Sand (Upper Cretaceous), and in 1922 gas was found in the Dakota Sandstone (Lower Cretaceous). Tensleep (Pennsylvanian) production was found in 1942, and Madison (Mississippian) oil was discovered in 1946. E. N. T.

Geophysics and Geochemical Prospecting.

527. An Evaluation of Present Day Geophysical Exploration for Oil. S. J. Pirson. *Oil Wkly*, 10.3.47, **125** (2), 45; 17.3.47, **125** (3), 39; 31.3.47, **125** (5), 37; 7.4.47, **125** (6), 45.—The usual physical methods of exploration are surveyed. Seismic reflection is by far the most useful. In the Elflex electrical method the depth of penetration varies with the frequency of the applied alternating current. Geochemical methods are considered but they are not favoured in the U.S.A. as they are neither cheap nor as simple in use as was hoped.

Wells can be examined by electric and radioactive logging. The electronic stratigrapher is useful for sands down to 6000 ft.

For combined stratigraphic and structural traps the magnetic and gravity methods

are almost useless except in special cases, and seismic methods are generally the best. The scope and limitations of seismic methods are considered, including the method of multiple events shooting. Radar and ultrasonics are useless because of strong absorption and scattering.

First, second, and third order anomalies are considered for both gravity and magnetic surveys. Shallow salt domes are the most easily detected intrusions because of their thick dense cap rock. Non-intrusive structures may be detected by third order anomalies after eliminating first and second orders by allowing for regional and structural topographic effects. Magnetic methods will confirm first order (intrusive) anomalies.

Efforts to develop a method employing telluric currents have not given positive results, but have caused much discussion.

Thermal methods are unlikely to be of use in the form of surface measurements. 100-ft holes would be required to reach a depth of thermal equilibrium. The logging is insensitive. In electrical logging, resistivity readings are ambiguous and can be misleading. Spontaneous potentials permit the detection of porous strata.

The S.P. dip-meter is useful when the angle between the well and the strata exceeds 10°. Anisotropy in conductivity may reveal the direction of a lens tip. Radioactive logging is especially valuable in cased wells. It can therefore be applied in old holes. Clays and shales are the most radioactive sediments. Neutron logging detects fluids (oil and water) and hence serves the same purpose as Self-Potentials in electrical logging. H. M.

528. Patent.—Texaco Development Corpn. B.P. 598,191, 25.2.48. Electrical apparatus for indicating the counting rate of a detector of penetrative radiation. G. R. N.

Drilling.

529. Fundamentals in the Design of Rock Bits. W. B. Noble. *Petrol. Engr*, Nov. 1947, **19** (2), 141.—See Abstract No. 40 (1948).

530. Automatic Drilling Control. M. E. True and R. R. Crockston. *Petrol. Engr*, Dec. 1947, **19** (3), 136.—See Abstract No. 146 (1948).

531. Directional Drilling. V. Shepherd. *Oil Gas J.*, 5.2.48, **46** (40), 69.—Controlled directional drilling is the art of causing a well bore to deviate from the vertical along a predetermined course. Necessities in achieving this end are: (1) A survey instrument to determine progress. This is usually a single shot camera in conjunction with a plumb-bob and a magnetic needle and card. This gives deflexion from vertical and orientation. (2) A removable deflexion tool, *e.g.*, whipstock, knuckle-joint, or spudding-bit. (3) A means of orienting the deflexion tool. This may be done from the surface or by means of a survey instrument as above. (4) Experienced personnel. C. G. W.

532. Modern Rotary Drilling. Parts 41 to 50. J. Zaba. *Oil Gas J.*, 18.10.47, **46** (24), 155; 25.10.47, **46** (25), 127; 1.11.47, **46** (26), 89; 8.11.47, **46** (27), 85; 15.11.47, **46** (28), 343; 22.11.47, **46** (29), 95; 6.12.47, **46** (31), 119; 13.12.47, **46** (32), 121; 1.1.48, **46** (35) 67; 8.1.48, **46** (36), 81.—A further 10 articles in the series on various aspects of modern rotary drilling. Titles are: (41) Compounding of engines and transmission equipment. (42) Circulating system. (43) Mud systems annular velocities. (44) Mud circulating pressures. (45) Increased size drill pipe. (46) Mud data. (47) Pump selection. (48) Steam slush pumps. (49) Power slush pumps. (50) Power slush pump characteristics. C. G. W.

533. Power Slips Increase Drilling Efficiency. E. Short. *Oil Gas J.*, 22.1.48, **46** (38), 72.—Power slips are stowed completely out of the way when not in use, and may be swung into position by one man in less time than a set of tongs is put on. Slips are operated by a foot control valve. The speed of setting the slips may be adjusted to suit the operator. Estimated time saving is 4–6 min. per 1000 ft of depth. C. G. W.

534. Application of Internal Combustion Engine Power to Rotary Drilling Rigs. W. S. Crake. *Petrol. Engr*, Dec. 1947, **19** (3), 70.—See Abstract No. 26 (1948).

535. Drill Collars. Their Use and Manufacture. R. J. Stoup. *Oil Gas J.*, 22.1.48, **46** (38), 62.—Important points in the care and use of drill collars are listed. Notes and photographs of the processes of manufacture are also given. C. G. W.

536. Non-destructive Testing of Drill-Pipe. R. C. McMaster and H. M. Banta. *Petrol. Engr*, Nov. 1947, **19** (2), 64.—Non-destructive methods of inspecting and testing drill-pipe are required for two purposes: (1) to prevent faulty pipes from being dispatched from the mills for drilling-rig service, as this would cause early failures in the field; and (2) to detect the effects of corrosion and fatigue in drill-pipe in use in the field and thus prevent twist-offs due to these causes.

The nature of drill-pipe failures and their relation to drill-pipe defects are discussed: the causes and effects of various mill defects, such as laps, seams, plug cuts, etc, are studied and compared with field defects resulting from corrosion and fatigue. Present mill- and field-inspection methods are outlined and several possible methods for mill- and field-testing are described. These include: (1) magnetic particle ("Magnaflux") inspection; (2) sensitive-surface magnetic-field measurement; (3) gamma-ray or X-ray inspection methods which respond to local stress concentrations; (4) electric-current-conduction tests; (5) eddy-current-induction tests; (6) supersonic reflection and transmission methods; (7) air, liquid, and vacuum leak tests; (8) electro-mechanical caliper methods; and (9) cyclograph testing. Procedures are suggested for improving both mill- and field-inspection of drill pipe, by the experienced use of one or more of these testing methods. R. B. S.

537. New Method for Evaluating the Effect of Chemical Treatment on Drilling Mud. N. E. Martello. *Oil Gas J.*, 8.1.48, **46** (36), 70.—A laboratory pilot unit for testing muds under field conditions is described. This is a recirculating apparatus comprising a large centrifugal pump, a heated section, and a valve arrangement for sampling. The system is made in copper and brass, capacity 2·6 gal circulated at about 20 g.p.m. Details and diagrams of the apparatus are given and operation described. C. G. W.

538. Patent.—L. C. Moore and Co. Inc. B.P. 598,048, 25.2.48. Oil-well masts or derricks. G. R. N.

Production.

539. New Acidizing Equipment Designed for Portability. Anon. *Petrol. Engr*, Dec. 1947, **19** (3), 134.—Some new acidizing equipment is briefly described. R. B. S.

540. Design and Construction of Compressor Plants. P. D. Torrey. *Petrol. Engr*, Dec. 1947, **19** (3), 108. (*Paper presented before S.W. District Division of Production, A.P.I., Shreveport, Louisiana*, May 1946.)—The author discusses the design and construction of plants for the compression and injection of air or gas into partially depleted reservoirs. The necessity for preliminary tests to select adequate compressor facilities is stressed: if insufficient natural gas is available it is necessary to use air for repressuring and this will produce corrosion problems and give rise to hazards from possible explosions.

The pertinent factors in compressor-plant design which are discussed are: (1) the nature of the compression of the gas; (2) the power requirements of compressors and fuel control; (3) the displacement and capacity of compressors; (4) the efficiency of compressors; (5) the effect of supercompressibility of natural gas on compressor performance; (6) the choice of one- or two-stage compression; (7) the pipe connexions for compressor installations; (8) the cooling system; (9) the quality of cooling water and water treatment; (10) cooling towers and heat exchangers; (11) air and gas filters; (12) oil coolers and filters; (13) safety devices; (14) plant buildings; and (15) the selection of compressor machinery. Formulæ are presented for the calculation of brake horse-power requirements, the volumetric displacement of the compressors, and compressor efficiency. The need for close control of engine fuel and for consideration

of the supercompressibility factor are emphasized, and it is shown that if the ratio between intake and discharge pressure is much greater than from 4·5 to 5 two stages of compression should be used. Adequate-sized pipe connexions for intake and discharge and an efficient cooling system are essential for economic operation. Some information is given of the volume of cooling water required; specifications for quality of cooling water are also given; and methods of water treatment in common use are described.

Compressor-plant layout and general construction details are also discussed. Sixteen references are appended. R. B. S.

541. Development in Cementing Casing Technique. G. E. McClatchey. *Oil Gas J.*, 8.1.48, **46** (36), 56.—The importance of proper cementing to production is emphasized. The use of wall-scratchers to remove the wall cake, and of casing centralizers have proved to be effective in improving cementation. Field experience and procedure with the equipment is described. C. G. W.

542. Corrosion of Oil Well Equipment. L. C. Case. *Petrol. Engr*, Dec. 1947, **19** (3), 150. (*Paper presented before A.S.M.E. Houston, Texas*, Oct. 1947.)—The causes of corrosion of well equipment are reviewed. It is shown that the oil–water ratio and the nature of the oil can be significant factors as well as the nature of the water. The use of resistant materials, alloys and coatings, and chemical methods of combating corrosion are discussed. Formaldehyde has proved effective in combating sulphide corrosion in many areas, and oil-wetting agents have proven inhibitory. The use of the latter has not, however, been fully investigated at present. R. B. S.

543. Inhibiting Subsurface Sulphide Corrosion. P. L. Menaul. *World Oil*, Oct. 1947, **127** (6), 150.—The manner in which sulphides cause corrosion and eventual failure of subsurface well equipment is briefly explained. This corrosion can be almost entirely prevented by the daily injection of formaldehyde into the annulus of affected wells. Cases are cited of wells which after the installation of formaldehyde injection have been operated at a profit even where sulphide-corrosion damage had previously completely prevented economic operation. The technique employed in formaldehyde injection is briefly discussed and three references are appended. R. B. S.

544. Effect of Water Injection in Gas Drive. D. E. McKenzie. *Oil Gas J.*, 22.1.48, **46** (38), 78.—Investigations of the effects of water injection in gas drive were made by injecting slugs of water into a core during an air–gas drive. Conclusions reached were: (1) increased oil production when using both a close-cut oil and a Venango crude; (2) increase in production is greater when the water is injected in slugs than when a full water drive is imposed; (3) reduced volumes of air are required; (4) the amounts of air blown through high-permeability formations is reduced.

Similar results were achieved on different types of cores. The laboratory procedure and the data on which the above conclusions are based, are presented in full. C. G. W.

545. Heating High-Pressure Gas Flow Lines to Eliminate Freezing at the Regulator. J. E. Kastrop. *World Oil*, Oct. 1947, **127** (6), 157.—The construction and installation of a simple flow-line heater for the prevention of hydrate freezing at the regulator in high-pressure gas-flow lines is described. This method utilizes standard equipment usually found on a lease, and may be cheaply installed. A diagrammatic sketch of the complete heating system is presented which shows the connexion and relationship between the component parts. R. B. S.

546. Crude Stabilizers in Venezuela Fields. J. G. Coultrup. *Petrol. Engr*, Nov. 1947, **19** (2), 156.—A description is given of three crude stabilization plants in operation in Venezuela. R. B. S.

Oilfield Development.

547. Post-war Gains outside U.S. Exceed Domestic Increases by 33%. W. W. Burns. *Oil Gas J.*, 29.1.48, **46** (39), 196.—World oil output averaged 8,387,400 b.d. in 1947, a rise of 759,300 b.d. over 1946 and 2,931,800 b.d. over 1938.

A table gives the daily output by countries for 1938, 1946, and 1947. G. D. H.

548. U.S. Crude Production Neared 2-billion-brl Mark in 1947. H. D. Ralph. *Oil Gas J.*, 29.1.48, **46** (39), 164.—During 1947 the U.S.A. produced 1,896,679,000 brl of oil, 147,907,000 brl more than in 1946. Texas gave 848,290,000 brl in 1947, an increase of 83,697,000 brl over 1946. The 1947 outputs were records in California, Colorado, Louisiana, Mississippi, New Mexico, and Texas.

Tables give the U.S. 1947 oil output by States, the numbers of producing wells, the average output per well, and the yearly output since 1942. G. D. H.

549. 110 Fields Produce nearly 50% of Oil in 1947. H. David. *Oil Gas J.*, 29.1.48, **46** (39), 167.—110 U.S. oilfields with reserves estimated at over 100,000,000 brl each, and representing about 1% of the total fields discovered in that country, have given over 55% of the U.S.A.'s cumulative output. Their reserves amount to 61% of that country's proven reserves. These major fields are currently giving 49% (929,800,000 brl) of the U.S. oil output.

It appears that the U.S. requires about 22 new major fields to maintain the balance between reserves and output which has existed in the past.

The major fields are listed with discovery year, estimated ultimate recovery, remaining reserves, cumulative output, 1947 and 1946 production, type, and age of pay. G. D. H.

550. Annual and Cumulative Production, Remaining Reserves by Fields. Anon. *Oil Gas J.*, 29.1.48, **46** (39), 219.—The larger fields in the U.S.A. are listed with the 1947 production, cumulative production and estimated reserves on 1.1.48, and the number of wells. G. D. H.

551. Exploratory, and Development Drilling—where it occurred and the results. Anon. *Oil Gas J.*, 29.1.48, **46** (39), 252.—A series of tables give by States, a summary of the 1947 drilling, development and wildcat, by fields and months. The results of completions are classified. G. D. H.

552. Economics of Alaskan Exploration. K. M. Fagin. *Petrol. Engr*, Dec. 1947, **19** (3), 57.—The economical aspects of the U.S. Navy's oil-prospecting activities in northern Alaska are discussed. R. B. S.

Refinery Operations.

Refining and Refinery Plant.

553. Patents.—W. C. Holmes & Co and C. Cooper. B.P. 597,472, 11.2.48. Distillation of hydrocarbons.

554. N.V. de Bataafsche Petroleum Mij. and W. H. Parks. B.P. 597,751, 18.2.48. Pumps. G. R. N.

Distillation.

555. Arkansas Fuel Oil Co. Completes Panola Gasoline Plant. C. D. Attaway. *Oil Gas J.*, 19.2.48, **46** (42), 118.—The new Panola, East Texas, gasoline plant is described. Located on the Daniels lease in Carthage field, this plant has a capacity of 100,000 cu. ft daily.

Gas is delivered to the plant from 28 wells. The plant includes dehydration, vapour recovery still, and rectifier units, together with conventional depropanizer, fractionator, and de-ethanizer equepment.

Products obtained include absorption oil, kerosine, diesel fuel, motor gasoline, butane, propane, and other liquified petroleum products.

Modern steel loading rack for 10 tank cars is provided, and adequate storage for plant production and blending stock is available. G. A. C.

Cracking.

556. First Turnaround of Leonard T.C.C. Unit Takes only 4557 Man Hours. Anon. *Oil Gas J.*, 19.2.48, **46** (42), 112.—Complete inspection of the T.C.C. installation at Alma, Mich., after an initial run of 222 days, is described.

With 40 men per day (two crews of 20 men each) work was completed in 10½ days. 2954 man hours were spent in inspection and maintenance of conventional refinery equipment, and only 425 on the catalytic section.

The three largest items of repair were renewal of sections of transfer lines between heaters and tar separator, renewal of hot-tar lines from bottom of tar separator, and cleaning of wet gas compressors in gas plant.

All of the fractionating towers were in good condition, and there was not an excessive amount of fouling in any heat exchanger.

Tables show man-hour requirements for plant by job items and crafts, both for total plant and catalytic section. G. A. C.

557. Patents.—Koppers Co. Inc. B.P. 596,879, 28.1.48. Method of pyrolysing a hydro-aromatic compound.

558. J. C. Arnold (Standard Oil Development Co). B.P. 597,886, 18.2.48. Treatment of naphthas to recover *iso*paraffins and to produce motor fuels.

559. Anglo-Iranian Oil Co. Ltd. and L. C. Strang. B.P. 598,109, 25.2.48. Hydrofining of gas oils and the hydroforming of naphthas.

560. C. Arnold (Standard Oil Development Co.). B.P. 598,173, 25.2.48. Process and apparatus for contacting powdered solids with gaseous fluids.

561. Standard Oil Development Co. B.P. 598,228, 25.2.48. Method of and apparatus for the interaction of gaseous fluids with solid materials and more especially for the catalytic conversion of hydrocarbon oils.

562. C. Arnold (Standard Oil Development Co.). B.P. 598,541, 3.3.48. Clay catalytic materials. G. R. N.

Polymerization.

563. Patents.—C. Arnold (Standard Oil Development Co.). B.P. 597,643, 11.2.48. The polymerization of olefin hydrocarbons.

564. C. Arnold (Standard Oil Development Co.). B.P. 598,323, 25.2.48. Polymerization of olefins. G. R. N.

Alkylation.

565. Patents.—J. C. Arnold (Standard Oil Development Co.). B.P. 597,210, 4.2.48. Catalytic alkylation of paraffins and olefins. G. R. N.

Chemical and Physical Refining.

566. Patents.—Shell Development Co. B.P. 597,655, 11.2.48. Conversion of hydrosulphides to neutral sulphur compounds.

567. P. J. Wilson. B.P. 597,895, 18.2.48. Processing acid sludge from the refining of petroleum products.

568. C. Arnold (Standard Oil Development Co.). B.P. 598,238, 25.2.48. Process for the separation of paraffins from hydrocarbon mixtures.

569. K. Williams. B.P. 598,557, 3.3.48. Desulphurization of hydrocarbons. G. R. N.

Special Processes.

570. Patents.—N.V.I. Hydro-Maity. B.P. 597,053, 28.1.48. Hydrogenation of synthetic hydrocarbon oils.

571. C. Arnold (Standard Oil Development Co.). B.P. 597,221, 4.2.48. Oxidation processes.

572. Standard Oil Development Co. B.P. 597,223, 4.2.48. Production of ethylbenzene.

573. Standard Oil Development Co. B.P. 598,041, 18.2.48. Synthesis of hydrocarbons.

574. J. C. Arnold (Standard Oil Development Co.). B.P. 598,103, 25.2.48. Catalytic hydrogenation of olefins.

575. J. C. Arnold (Standard Oil Development Co.). B.P. 598,178, 25.2.48. Manufacture of aviation gasoline.

576. Standard Oil Development Co. B.P. 598,380, 3.3.48. Synthesis of liquid hydrocarbons. G. R. N.

Metering and Control.

577. Electrically Operated Remote Indicators. F. R. Axworthy. *Instrum. Prac.*, 1948, **2**, 135–139.—Electrical and electronic circuits can be utilized to transmit any information directly translatable into a pointer deflexion, over practically any distance to one or more repeater stations. The principles of typical commercially exploited circuits are described, with some notes on applications, *viz.*, valve position indication, liquid level, and flow recording, etc. R. T. D.

PRODUCTS.

Chemistry and Physics.

578. Table of Azeotropes and Non-Azeotropes. L. H. Horsley. *Anal. Chem.*, 1947, **19**, 508.—A collection of 6460 azeotropes and non-azeotropes in tabular form taken largely from the literature arranged according to the Chemical Abstracts system. G. R. N.

579. Chemical Nature of Coal Hydrogenation Products. I. M. B. Neuworth. *J. Amer. chem. Soc.*, 1947, **69**, 1653.—A study has been made of the primary hydrogenation products of coal prepared by the high-pressure catalytic hydrogenation of a Pittsburgh Seam coal in an autoclave, modified to permit the simultaneous hydrogenation and distillation of the volatile products into a cooled receiver. By chromatographic adsorption these products have been initially resolved into four characteristic fractions according to their aromatic content and the presence or absence of oxygen, nitrogen, and sulphur. By a study of the ultra-violet spectra and ultimate analyses, information has been obtained on the structure of the components of these various fractions. G. R. N.

580. Dielectric Studies. IX. Studies with Gasoline. N. C. C. Li and T. D. Terry. *J. Amer. chem. Soc.*, 1948, **70**, 344.—Dipole moment can be measured using gasoline as solvent, a substance which has no definite molecular weight and whose physical properties may vary greatly with different samples. Results indicate that gasoline and its fractions are essentially non-polar. A summary of the dipole-moment values obtained using gasoline and similar solvents of indefinite mol. wt. is given, and shown to be in close agreement with values obtained using non-polar solvents of known mol. wt. G. R. N.

581. Heterogeneity of Catalyst Surfaces. II. H. S. Taylor and S. C. Liang. *J. Amer. chem. Soc.*, 1947, **69**, 2989.—Zinc oxide–chromium oxide catalysts and chromium oxide gel reveal heterogeneity of surface by techniques of measuring chemisorption with increasing and decreasing temperatures at constant pressure, as previously noted in the case of zinc oxide. Manganous oxide–chromium oxide catalysts do not show desorption–readsorption phenomena on raising the temperature. The isobar on decreasing temperature is consequently horizontal over a considerable temperature range. The surface nevertheless shows a partial heterogeneity. G. R. N.

582. Kinetics of Carbiding and Hydrocarbon Synthesis with Cobalt Fischer–Tropsch Catalysts. S. Willer. *J. Amer. chem. Soc.*, 1947, **69**, 2432.—Rates of carbiding, of hydrogenation of carbide, and of hydrocarbon synthesis from carbon monoxide–hydrogen mixtures have been measured for a cobalt–thoria–kieselguhr catalyst (100 : 18 : 100) with the use of a circulating gas system. The initial carbiding rate is comparable with the synthesis rate, but the steady rate of bulk carbiding is about one tenth as large. The apparent activation energies for bulk carbiding and for the synthesis are 31 and 26 k. cal/mol respectively. Within the pressure range 8–45 cm the pressure dependence of the carbiding rate can be expressed : Rate $= kp^n$ where n is 0·20–0·26. Some of the implications of the experimental results for the mechanism of the carbiding and synthesis are discussed. G. R. N.

583. X-Ray Diffraction Studies of the Action of Carbon Monoxide on Cobalt–Thoria–Kieselguhr Catalysts. I. L. J. E. Hofer and W. C. Peebles. *J. Amer. chem. Soc.*, 1947, **69**, 2497.—Reduction of the Fischer and Hall type Fischer–Tropsch catalysts at 400° C leaves the cobalt in the face-centred cubic (β) form which does not convert readily to the hexagonal close-packed (α) form. On carburization of the reduced catalyst, the cobalt is converted to the same carbide previously reported. The carburization of α and β cobalts as associated with kieselguhr, thoria, and magnesia proceeds at nearly the same rates and results in the same crystalline carbide. Hydrogenation of the carbide forms methane and the stable α cobalt. The cycle of carbiding the cobalt in the reduced catalyst and hydrogenating the carbide so formed can be repeated apparently indefinitely at 210° C. G. R. N.

584. Studies of the Fischer–Tropsch Synthesis. II. Properties of Unreduced Cobalt Catalysts. R. B. Anderson, W. K. Hall, H. Hewlett, and B. Seligman. *J. Amer. chem. Soc.*, 1947, **69**, 3114.—The areas of unreduced precipitated cobalt Fischer–Tropsch catalysts were several times greater than those of the kieselguhr used as carriers. Catalysts prepared with natural kieselguhrs had larger areas than those prepared with calcined or flux-calcined kieselguhrs. Areas of unreduced catalysts varied from 60 to 150 sq. m/g Average pore diameters of granular catalysts varied from 500 to 770 Å and for pelleted catalysts from 165 to 310 Å. The surface areas of pelleted catalysts were 10–20% lower than the areas of the corresponding granules. It was shown that the cobalt basic carbonate-promoter complex was precipitated chiefly in the void space of the kieselguhr. Preparations without promoters, kieselguhr, or both, had areas of the cobalt complex per g of complex that were roughly equal to the area of the complex of the catalyst. Natural kieselguhr as a carrier considerably increased the area of the cobalt complex. Catalysts prepared in small batches were quite reproducible with respect to surface area but the area of catalysts prepared in large batches varied considerably. G. R. N.

585. Structure Studies on Chromium–Aluminium Oxide and Related Catalyst Systems. R. P. Eischens and P. W. Selwood. *J. Amer. chem. Soc.*, 1947, **69**, 2698.—Magnetic susceptibilities have been used together with X-ray and surface-area studies to elucidate the structure of supported oxides of chromium, molybdenum, tungsten, and uranium. G. R. N.

586. Chromium–Aluminium Oxide Catalyst System. R. P. Eischens and P. W. Selwood. *J. Amer. chem. Soc.*, 1947, **69**, 1590.—Magnetic susceptibilities have been measured for a series of catalysts of varying composition, but all containing chromium oxide supported on alumina. Variations in the susceptibility of the chromium in

these catalysts is used to derive possible structures for the catalyst surface. The relation between magnetic susceptibility and concentration is named the susceptibility-composition isotherm. G. R. N.

587. Alkylbenzenes from Benzene and *iso*Butene. I. D. I. Legge. *J. Amer. chem. Soc.*, 1947, **69**, 2079.—Benzene has been alkylated with *iso*butene at 15–22° C in the presence of $AlCl_3$. The following hydrocarbons were isolated from the complex reaction product: *tert.*-amylbenzene, 1-*iso*propyl-2-*tert.*-butylbenzene, 1-*iso*propyl-3-*tert.*-butylbenzene, 1 : 4-di-*tert.*-butylbenzene, 1-*tert.*-amyl 2-*tert.*-butylbenzene and *tert.*-octylbenzenes. The higher-boiling material consisted mainly of *p*-dialkylbenzenes. No tri-*tert.*-butylbenzene was detected. *tert.*-Amylbenzene and 1-*iso*propyl-3-*tert.*-butylbenzene were also formed when sulphuric acid was the catalyst. The probable course of the reaction is outlined on the basis of modern electronic concepts. G. R. N.

588. Thermodynamics of Butadiene-1 : 2. J. G. Aston and G. J. Szasz. *J. Amer. chem. Soc.*, 1947, **69**, 3108.—The heat capacities of butadiene-1 : 2 have been measured from 14° to 284° K. The solid–liquid equilibrium temperature and the heat of fusion have been determined. The melting point is 136·95° K (— 136·21° C). The vapour pressures have been determined from 200° to 289° K, and the results represented by an equation leading to a value for the normal b.p. and to values of the heat of vaporization at 230°, 250°, and 290° K. The normal b.p. is 10·84° C. The heat of vaporization has been determined at 273·25° K. An assignment of the fundamental frequencies has been made, and the comparison between the calculated and observed entropies yielded a value of 1650 ± 400 cal/mol for the potential barrier hindering the internal rotation of the methyl group. G. R. N.

589. Heats of Adsorption on Carbon Black. II. R. A. Beebe, M. H. Polley, W. R Smith, and C. B. Wendell. *J. Amer. chem. Soc.*, 1947, **69**, 2294.—The differentia heats of adsorption were measured of a series of saturated and unsaturated hydrocarbons on a number of carbon blacks of varying rubber-reinforcing ability. The magnitude of the heats appears to indicate that the adsorption of both saturated and unsaturated hydrocarbons is essentially of the van der Waals type. The differences in surface activity as shown by the heat measurements with hydrocarbons as with the elementary gas adsorbates appears to parallel the rubber-reinforcing properties of the blacks. No marked difference was found between the differential heats of adsorption for the saturated and corresponding saturated hydrocarbons. The results so far lend no support to the theory that the reinforcing effect of carbon black in rubber is associated with the unsaturated character of the latter. G. R. N.

590. Thermodynamics and Molecular Structure of *cyclo*Pentane. J. E. Kilpatrick, K. S. Pitzer, and R. Pitzer. *J. Amer. chem. Soc.*, 1947, **69**, 2483.—The published data from electron diffraction, Raman and infra-red spectra, entropy and specific-heat measurements have been combined to develop as complete a picture of the structure of the *cyclo*pentane molecule. Most striking is the result that the puckering of the ring is not of a definite type, but that the angle of maximum puckering rotates around the ring. Other properties prove to be consistent with this conclusion. Among the results obtained are an assignment of vibration frequencies and tables of the thermodynamic functions $-(F - H_0)/T$, S, $(H - H_0)/T$ and C_p for the range 298·16–1500° K. G. R. N.

591. Thermodynamics and Molecular Structure of *cyclo*Hexane and some of its Alkyl Derivatives. C. W. Beckett, K. S. Pitzer, and R. Pitzer. *J. Amer. chem. Soc.*, 1947, **69**, 2488.—The data for *cyclo*hexane from electron diffraction, Raman and infra-red spectra, and thermodynamic measurements were analysed in various ways to give an assignment of vibration frequencies and calculated values of the heat capacity, entropy, and heat and free-energy functions for this hydrocarbon in the ideal gas state from 298·16° to 1500° K. It is concluded that at room temperature *cyclo*hexane is predominantly in the chain form of symmetry D_{3d}. However, the heat capacity of gaseous *cyclo*hexane definitely shows a contribution from conversion to the boat form, which is approx. 5·6 k. cal/mol higher in energy. The possibilities of geometrical

tautomerism in the methyl- and dimethyl-*cyclo*hexanes are discussed. It is shown that the energy differences between these tautomers are related to the strain or steric energies in *n*-paraffins, and that there is good agreement between the corresponding energy quantity obtained from data on each series of compounds. The heats of isomerization confirm the assignment of the configuration *cis*-1 : 3-dimethyl*cyclo*hexane to the isomer boiling at 120·1° and trans-1 : 3 to the isomer boiling at 124·5°. The thermodynamic functions mentioned above were calculated also for methyl, ethyl, and the seven dimethyl*cyclo*hexanes in the ideal gas state. G. R. N.

592. Catalytic Decomposition of Ethane and Ethane–Hydrogen Mixtures. C. Kemball and H. S. Taylor. *J. Amer. chem. Soc.*, 1948, **70**, 345.—The mass spectrometer can be used to follow the reaction of ethane and hydrogen to produce methane. The ethane–hydrogen decomposition on a supported nickel catalyst obeys the expression, rate $= kp_{C_2H_6}{}^{0\cdot7}p_{H_2}{}^{-1\cdot3}$, over a wide range of composition with an energy of activation of 52 k. cal/mol. At low ratios of hydrogen–ethane, abnormal kinetics, depending on a high inverse power of the hydrogen pressure, set, in ; this is ascribed to heterogeneity of the surface. Ethane will decompose quantitatively over this catalyst to methane and carbon with a rate dependent on $p_{C_2H_6}{}^{0\cdot7}$ and an energy of activation of 40 k. cal/mol The carbon is reversibly deposited, and can be converted to methane by hydrogen. G. R. N.

593. Catalytic isomerization of *n*-Hexane. A. F. Nikolaeva. *J. Gen. Chem.* (*U.S.S.R.*), 1946, **16**, 1819–22 ; *Rev. Inst. Franç. Pétrole*, 1947, **2**, 529.—In continuation of the study of the isomerization of normal paraffinic hydrocarbons, with particular reference to the formation of isomers containing quaternary carbon, under the influence of molybdenum sulphide, *n*-hexane was treated with hydrogen, under pressure, in the presence of 10% of MoS_2. The initial pressure was 140 atm, the temperature 400° C, and the duration of the test 12 hr. The isomerization product (80·8% yield) had I.B.P. 33° C with 90·7% distilling in the range 48–66·5° C. By an examination of the Raman spectra, the following hydrocarbons were identified in the 45–55° C fraction : 2 : 2-dimethylbutane (15%), 2 : 3-dimethylbutane (5%), 2-methylpentane (80%). In the fraction boiling at 55–65° C these hydrocarbons are present in the ratio 10·5 : 8 : 5 whilst the 65–80° C cut is largely hexane. Traces of 3-methylpentane were detected, whilst methyl*cyclo*pentane and *cyclo*hexane were absent. V. B.

594. Kinetics and Mechanism of the Thermal Decomposition of *n*-Heptane. W. G. Appleby, W. H. Avery, and W. K. Meerbott. *J. Amer. chem. Soc.*, 1947, **69**, 2279.—The thermal decomposition of *n*-heptane has been studied by a flow method in the temperature range 550–630° C at pressures of 1 and 8·7 atmospheres. Complete analysis of the reaction product was made by use of a method of multi-isothermal distillation for determination of the gaseous product combined with olefin analysis of the liquid product. In agreement with the predictions of the Rice theory and experimental observations of Dintses, only traces are found of saturated products having more carbon atoms than propane. The composition and concentration of the decomposition products are in excellent agreement with the amended Rice theory. The rate of decomposition is of the modified first-order type, where inhibition by products causes the first-order-rate constant to decrease with increase of conversion. The activation energy, calculated from the temperature variation of the first-order rate, is 65,000 cal. G. R. N.

595. Vapour Heat Capacities and Heats of Vaporization of *n*-Hexane and 2 : 2-Dimethylbutane. G. Waddington and D. R. Douslin. *J. Amer. chem. Soc.*, 1947, **69**, 2275.—The heat capacities of the vapours of *n*-hexane and 2 : 2-dimethylbutane were measured at several pressures in the temperature range 33–470° K. The experimental values of the heat capacities of the vapours in the ideal gas state deviate from the following empirical equations by less than 0·1% :

$$n\text{-Hexane } C_p^0 = 4\cdot280 + 0\cdot10573T - 1\cdot9948 \times 10^{-4}T^2$$
$$2:2\text{-Dimethylbutane } C_p^0 = -2\cdot558 + 0\cdot13724T - 5\cdot339 \times 10^{-5}T^2$$

The heats of vaporization were measured, and are represented with an accuracy of approx. ±0·1% in the range from 25° to the normal boiling points by the equations :

$$n\text{-Hexane } \Delta H_{vap.} = 8571 + 6\cdot372T - 0\cdot03298T^2$$
$$2:2\text{-Dimethylbutane } \Delta H_{vap.} = 8149 + 2\cdot37T - 0\cdot0252T^2$$

Second virial coefficients, which represent the low-temperature, low-pressure behaviour of the vapours were also derived from the thermal measurements. G. R. N.

596. Preparation of Optically Active Hydrocarbons. R. L. Letsinger. *J. Amer. chem. Soc.*, 1948, **70**, 406.—(−)1-Phenyl-2-methylbutane and (+)1-phenyl-2-methyloctane were prepared in good yields by the reaction of benzylsodium with (+)2-bromobutane and (+)2-bromo-octane, respectively. (+)1-Phenyl-2-methylbutane was prepared by the condensation of phenylsodium with (+)2-methyl-1-bromobutane. The extent of racemization in the reaction of benzylsodium and 2-bromobutane was estimated, and the stereochemical relationships were discussed. G. R. N.

597. High Mol. Wt Hydrocarbons. II. M. D. Soffer, N. S. Strauss, M. D. Trail, and K. W. Sherk. *J. Amer. chem. Soc.*, 1947, **69**, 1684.—Five new hydrocarbons, 1 : 14-diphenyltetradecane, 1-phenyl-12-*n*-propylpentadecane, 4-phenyl-13-*n*-propylhexadecane, and the *cyclo*hexyl analogues of the latter two have been prepared in a high state of purity using dimethyl sebacate as the starting material. G. R. N.

598. Condensation of Saturated Hydrocarbons with Halo-olefins. II. L. Schmerling. *J. Amer. chem. Soc.*, 1948, **70**, 379.—A trichloride, 1 : 1 : 2-trichloro-3 : 3-dimethylbutane, is the principal product of the reaction of *iso*butane with 1 : 2-dichloroethylene in the presence of $AlCl_3$ at room temperature. It is obtained in 35% yield when *cis*dichloroethylene is used and in less than 5% yield when *trans*dichloroethylene is used. The probable mechanism of the reaction is presented. It is shown that the reaction serves as a means of evaluating recently proposed mechanisms for the alkylation of *iso*paraffins with olefins. G. R. N.

599. Transformation of Hydrocarbons on Aluminosilicate Catalysts. II. Methyl*cyclo*hexane. G. N. Maslianskii, E. I. Mezhebovskaya, and T. S. Berlin. *J. Gen. Chem.* (*U.S.S.R.*), 1946, **16**, 1823–30; *Rev. Inst. Franç., Pétrole*, 1947, **2**, 528.—Methyl*cyclo*hexane is treated at 515° C and atm pressure. The flow rate is 15–50 ml/hr; after 1 hr the catalyst is regenerated. Under such conditions there is marked formation of gaseous products in which paraffinic hydrocarbons predominate; the olefin yield increases with greater flow-rate. In addition to paraffins and olefins the low-boiling point fractions contain small quantities of dimethyl*cyclo*pentane and *cyclo*hexane. In addition to toluene which is the direct dehydrogenation product, there can be detected considerable amounts of polymethyl-benzenes, viz., xylenes, ethylbenzene, and trimethylbenzene. On decreasing the flow rate from 50 to 15 ml/hr the aromatic content of the catalysis product rises from 15 to 38%; the toluene yield is doubled whilst that of high-boiling aromatics is trebled.

By contrast with the behaviour of *cyclo*hexane under identical conditions methyl*cyclo*hexane is much more active, due to the presence of the methyl group. The rate of dehydrogenation is increased, the yield of aromatics increases from 8 to 38%, largely due to greater quantities of high-boiling aromatics. V. B.

600. Pyrolysis of Methane. A. S. Gordon. *J. Amer. chem. Soc.*, 1948, **70**, 395.—The decomposition of methane has been studied in a porcelain tube at temperatures between 1007° and 1075° C. The following observations were made: (1) within this range the first-order reaction constants increased with increasing decomposition; (2) there was a catalytic effect of acetylene probably homogeneous, which accounts for (1) since the percentage of acetylene increased with increasing percentage decomposition; (3) there was probably no effect of ethylene on the decomposition of methane; (4) there was a large catalytic effect of surface in the early stages of the reaction which disappeared by the time 30% of the methane was decomposed; (5) no induction period was found; (6) in the early stages of the decomposition, 50% nitrogen or steam in the entering gas resulted in about the same percentage of decomposition of the methane for equal contact time. G. R. N.

601. Correlation of Heats of Isomerization and Differences in Heats of Vaporization of Isomers, among the Paraffin Hydrocarbons. H. Weiner. *J. Amer. chem. Soc.*, 1947, **69**, 2636.—A method for calculating the heats of isomerization and the heats of

vaporization of all branched-chain paraffin hydrocarbons is described. The method expresses the difference in the value of the property between a given normal paraffin and its isomers as a linear function of two structural parameters. The required empirical constants were evaluated from the data on the 33 liquid paraffins C_5 to C_9. The average deviation of the calculated from the observed values for these paraffins is $\pm 0{\cdot}31$ k. cal/mol for the heat of isomerization and $\pm 0{\cdot}038$ k. cal/mol for the heat of vaporization. The simplified equations $-\Delta H_i = 0{\cdot}16\Delta t + 0{\cdot}02\Delta p$ and $\Delta H_{V_n} - \Delta H_V = 0{\cdot}05\Delta t - 0{\cdot}08\Delta p$ relate the heats of combustion and vaporization of the paraffins to their b.p. G. R. N.

602. Sulphur as a Promoter for a Nickel Catalyst in Dehydrogenation. H. Adkins, D. S. Rae, J. W. Davis, G. F. Hager, and K. Hoyle. *J. Amer. chem. Soc.*, 1948, **70**, 381.—Theophene-free benzene is not effective with a nickel catalyst at 350° C in the oxidation (dehydrogenation) of di*cyclo*hexyl to diphenyl. Benzene containing thiophene or diphenylsulphide in a suitable proportion to the weight of catalyst present brings about an almost quantitative conversion. G. R. N.

Analysis and Testing.

603. Determination of Antioxidants in Gasoline. R. Williams and B. R. Strickland. *Anal. Chem.*, 1947, **19**, 633.—Antioxidants are added to gasoline to inhibit the formation of gum and precipitation of lead and to maintain overall stability. Alkyl substituted *p*-aminophenol and *p*-phenylenediamine derivatives are the most commonly used inhibitors of high potency. Since many inhibitors may be lost from gasoline upon contact with acid, alkali, or water, it is often important to check the amount of inhibitor present. This determination proved of value during the war in investigating the stability of aviation gasoline supplies and is particularly useful in studying loss of inhibitor from gasoline. It is a colorimetric technique based on extracting amino-phenol- or phenylenediamine-type inhibitors from gasoline with aqueous HCl solution, the hydrochlorides being formed. When the extract is neutralized with Na_2CO_3 in the presence of phosphotungstic-acid solution, a blue coloration is produced which is proportional to the concentration of inhibitor present in the gasoline. G. R. N.

604. Technique for Measuring Reactivity of Gasoline Antioxidants with Air. B. R. Strickland. *Anal. Chem.*, 1948, **20**, 55.—An apparatus for measuring the rate and extent of reaction of gasoline antioxidants with air at room temperature and atmospheric air pressure consists of a closed system including a 20-litre reservoir of air, a pump for circulating the air, a tower for countercurrent contact of the antioxidant solution with air, and auxiliary portions such as traps and drying towers. An antioxidant to be tested is dissolved in alcohol or other suitable solvent. Air entering the reactor serves as an air lift to carry the antioxidant solution to the top of the packed reactor column, then separates and enters the bottom of the column for countercurrent contact in the tower with the antioxidant. Once started, the operation of the apparatus is entirely automatic. After periods of contacting, the vol of oxygen absorbed is measured, and reaction is continued until no more oxygen is absorbed. Typical results showing the reactivity of *n*-butyl-*p*-aminophenol and NN′-di-*sec*-butyl-*p*-phenylenediamine with air are presented. G. R. N.

605. Aromatics in Petroleum Fractions. M. R. Lipkin, W. A. Hoffecker, C. C. Martin, and R. E. Ledley. *Anal. Chem.*, 1948, **20**, 130.—A method is described for the determination of percentage of aromatics with an accuracy of 1% in hydrocarbon mixtures boiling above 200° C. The sample is separated by silica gel into aromatic and non-aromatic fractions which may be used for further analysis. This method classifies all hydrocarbons containing one or more aromatic rings as aromatics, whether the side chain is paraffin, olefin, naphthene ring, or *cyclo*-olefin. G. R. N.

606. Procedure for Determination of the Bromine Number of Olefinic Hydrocarbons. H. L. Johnson and R. A. Clark. *Anal. Chem.*, 1947, **19**, 869.—The procedure for bromine number given as a tentative A.S.T.M. standard (D − 875 − 46T) is described.

All hydrocarbons tested have been found to give results very close to theoretical except a few highly branched or sterically hindered olefins and anthracene.
G. R. N.

607. Determination of Carbon and Hydrogen in Petroleum Distillates. M. C. Simmons *Anal. Chem.*, 1947, **19**, 385.—A method determining simultaneously the carbon and hydrogen content of petroleum distillates, is based on their combustion in a special lamp suitable for aromatics as well as other hydrocarbon types. The lamp-combustion procedure simplifies difficulties normally encountered in the ultimate analysis of volatile samples, and refinements improve accuracy and permit use of relatively small samples. Routine determinations can be made, and maximum deviation for repeated analyses from mean is about 0·01% when 0·5–1·0-g samples are used. G. R. N.

608. Rapid Evaluation of Catalysts. M. H. Whitlock, G. J. Haddad, and E. E. Stahly. *Anal. Chem.*, 1947, **19**, 767.—In order to evaluate in a short time a large number of new catalysts for the production of butadiene from alcohol, a multiple-test apparatus has been developed that appraises 12 catalysts simultaneously. As only 20 cc of catalyst are required for each test, the apparatus permits the evaluation of catalysts which are difficult or time-consuming to prepare in large quantities. A feeder enables liquid addition at rates as low as 6 cc per hr with an accuracy of $\pm 10\%$. Gaseous products are scrubbed to remove soluble components and collected by displacing a salt solution in a constant-pressure system. Gas samples are taken by mercury displacement for analysis by chemical and physical methods. The apparatus is applicable to catalyst studies in which the feed is in the liquid state and of such a nature that it may be separated from the low-boiling products by countercurrent scrubbing. Soluble products may be separated by the use of appropriate solvents.
G. R. N.

609. New Method for Testing Catalysts. J. A. Hinckley, Jr., and H. R. Sheppard, Jr. *Anal. Chem.*, 1947, **19**, 771.—A new type of catalyst-testing system employs a device for continuously separating the reaction products from a catalyst-testing furnace. These fractions are more readily analysed than the converter-make collected as a whole. This new system resulted in improved accuracy in testing catalysts used for making butadiene from ethyl alcohol. G. R. N.

610. Pure Compounds from Petroleum. D. Rossini. *Anal. Chem.*, 1948, **20**, 110.—A description of the work at the National Bureau of Standards dealing with the separation of pure compounds from petroleum and with the purification and determination of purity of hydrocarbons, is presented. This report summarizes this work as carried out in co-operative investigations with the A.P.I., providing some substance to the philosophy propounded, and reducing to actual practice some of the principles described in the symposium on purity. The first part of this report surveys the problem of determining the composition of natural petroleum in terms of its individual components, and the latter part describes the work of purifying and determining the purity of hydrocarbons required for use as standard samples for calibrating analytical apparatus and instruments and for measuring needed physical thermodynamic and spectrographic properties. G. R. N.

611. Determination of *cyclo*Propane by Selective Absorption. F. R. Brooks, R. S. Mardock, and V. Zahn. *Anal. Chem.*, 1948, **20**, 62.—*cyclo*Propane can be determined in gases containing both olefins and paraffins by absorption of the olefins in acid mercuric sulphate reagent followed by absorption of the *cyclo*propane in 87% sulphuric acid. Ethylene can be distinguished from other olefins by a second analysis, in which the order of absorbents is reversed, and *cyclo*propane plus olefins other than ethylene is absorbed in 87% acid and then ethylene is absorbed in acid mercuric sulphate reagent. G. R. N.

612. Laboratory Low Temperature Fractional Distillation. C. E. Starr, Jr., J. S. Anderson, and V. M. Davidson. *Anal. Chem.*, 1947, **19**, 409.—A study was made of charging rates to laboratory distillation units, *e.g.*, Podbielniak types, of samples ordinarily encountered in petroleum-refinery plants. Overhead samples taken at

different charging rates have been analysed by mass spectrometer to determine the amount of contamination with higher-boiling constituents. The results obtained indicate that charging rates much higher than ordinarily employed may be used with equal accuracy and effects considerable economy of time. Supplementary data also show that for special applications, distillation rates may be increased several fold over rates now generally employed. G. R. N.

613. Nomographs for Distillation of Low Boiling Hydrocarbons. F. M. Nelsen, F. R. Brooks, and V. Zahn. *Anal. Chem.*, 1947, **19**, 814.—Two nomographs were constructed for use in the fractionation of liquefied gas samples by means of low-temperature distillation. One covers the range + 21° to − 85° C, while the other ranges from − 80° to − 175° C, the pressure range in each case being 30–1000 mm mercury. G. R. N.

614. Evaluation of the Ferrous Thiocyanate Colorimetric Method. C. D. Wagner, H. L. Clever, and E. D. Peters. *Anal. Chem.*, 1947, **19**, 980.—This method, first proposed by Young, Vogt, and Nieuwland, has been tested on a variety of autoxidized materials. It was found fundamentally accurate on hydrocarbon materials containing no conjugated diolefins; on diolefins the results varied considerably with time and were therefore of only empirical value. The precision was relatively poor (approx. ±5–10% of the absolute value), but the method was sensitive to very small peroxide concentrations. Presence of high polymer sometimes caused interference because of insolubility and turbidity. The effect of molecular oxygen on the results has been verified. The presence of dissolved oxygen is necessary to obtain quantitative peroxide results and the absence of oxygen gives very low results. G. R. N.

615. Evaluation of the Ferrous–Titanous Method. C. D. Wagner, R. H. Smith, and E. D. Peters. *Anal. Chem.*, 1947, **19**, 982.—The Yule and Wilson method was tested on a variety of autoxidized hydrocarbons and peroxides, including some pure peroxides of a type known to be present in autoxidized materials. The method generally gives results that represent only fractions of the true values. Precise results were obtained with peroxides in mono-olefins under ordinary conditions of application of the method, but it was necessary to control the experimental conditions carefully for precise results with diolefin peroxides. Being precise the method has empirical use if the results can be correlated with the properties of the material in question. The method is convenient for multiple analysis with the single disadvantage that initial preparation and storage of the reagents are more difficult than with other methods. G. R. N.

616. Determination of Gaseous Hydrocarbons. R. E. Murdock, F. R. Brooks, and V. Zahn. *Anal. Chem.*, 1948, **20**, 65.—A method is described for the rapid and quantitative determination of gaseous paraffins by combustion at 700° C over precipitated copper oxide containing 1% iron oxide. This method is an adaptation of that proposed by Brückner and Schick, and has great advantages over commonly employed methods that use copper-oxide wire which requires a temperature of around 900° C or combustion over a heated filament or catalyst which requires the addition of oxygen. Formation of explosive mixtures and the hazard created therby are eliminated. G. R. N.

617. Practical Test for Estimating Storage Stability of Gasolines. E. L. Walters, D. L. Yabroff, H. B. Minor, and H. E. Sipple. *Anal. Chem.*, 1947, **19**, 987.—A practical adaptation of the extrapolated gum time test for predicting the storage stability of gasoline is described. The original method required determination of gum times under several accelerated conditions to permit evaluation of test accelerants, temperature, and oxygen pressure. The modified procedure comprises a single ageing or gum time test under accelerating conditions, moderated to the extent that average effects may be assumed for test accelerants without introducing undue certainty in stability predictions. G. R. N.

618. Infra-red Analytical Techniques for Analysing C_5 Mixtures. V. Thornton and A. E. Herald. *Anal. Chem.*, 1948, **20**, 9.—Mistures of C_5 hydrocarbons have been analysed in the vapour phase rapidly and with sufficient precision for plant control. The analytical techniques were greatly simplified by the discovery that the extinction

per unit pressure was constant over a pressure range of 50–650 mm of mercury at 30° C for the two C_5 paraffins and six C_5 olefins under consideration. Small variations in the concentrations of components appearing in fractionation products were quickly measured by infra-red method, even though the components possessed relatively weak absorption bands, by comparing with a reference mixture. G. R. N.

619. Mass Spectrometer Analysis of Some Liquid Hydrocarbon Mixtures. R. A. Brown, R. C. Taylor, F. W. Melpolder, and W. S. Young. *Anal. Chem.*, 1948, **20**, 5.—A review of the application of mass-spectrometer analysis to the determination of C_5 to C_8 hydrocarbons in known and unknown mixtures is given. From the accumulated data it was concluded: all the C_6 and C_7 paraffin and *cyclo*paraffin hydrocarbons for which pure standards are available may be individually determined, with the exception of 2 : 2-dimethylpentane and 2 : 2 : 3-trimethylbutane which normally must be grouped and the 1 : 2 and 1 : 3-dimethyl*cyclo*pentanes which frequently must be grouped. Various octanes must be grouped according to the complexity of the sample and for stability in operation of the mass spectrometer. Under ideal conditions for narrow-boiling fractions, however, it is necessary to group only 4-methylheptane with 2 : 3 : 4-trimethylpentane and 2 : 3-dimethylhexane. In the absence of 4-methylheptane each of the remaining isomers can be resolved individually. In general, most of the C_8 *cyclo*paraffin isomers must be grouped, because of similarity in their cracking patterns. Benzene, toluene, ethylbenzene, and grouped xylenes may be resolved from most hydrocarbon mixtures. C_6 and heavier olefins and *cyclo*-olefins cannot be analysed directly on the mass spectrometer, because of pattern similarity and unavailability of pure calibrating samples. G. R. N.

620. Mass Spectrometer-Hydrochlorination Analysis of Butenes. F. W. Melpolder and R. A. Brown. *Anal. Chem.*, 1948, **20**, 139.—To improve the accuracy of determining individual butenes, *iso*butene is converted to *tert.*-butyl chloride prior to mass spectrometer analysis. Two special methods of computation have been devised, modifications of the basic principles of analyses proposed by Washburn, Wiley, and Rock. G. R. N.

621. Analysis of a Natural Gas. M. Shepherd. *Anal. Chem.*, 1947, **19**, 635.—A standard sample of natural gas was analysed by 50 laboratories in co-operation with Subcommittee D-3-VII of the A.S.T.M. The conventional chemical methods were used by 30 laboratories, and the other 20 employed the mass spectrometer. The results are compared in this report. G. R. N.

622. Determination of Olefinic Unsaturation. E. T. Scafe, J. Herman, G. R. Bond, Jr., and Co-operators. *Anal. Chem.*, 1947, **19**, 971.—Two standardized procedures for the determination of olefins by reaction with nitrogen tetroxide were co-operatively evaluated by an A.S.T.M. group. The results of this work indicate that the methods give a satisfactory value for total olefin content of hydrocarbon mixtures in the gasoline-boiling range, which contain other than highly branched olefins. Further work is planned on highly branched olefins of the di- and tri-*iso*butylene type. The need for estimating olefin molecular weights required with bromine number methods is eliminated. Method A provides an olefin-free portion of the test sample, which is suitable for additional analysis for other hydrocarbon types. Future work will further improve the precision and accuracy of the methods. G. R. N.

623. Simple Permeability Meter. R. Metrot. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 518–520.—The instrument described and illustrated, in which air is drawn through the sample core by water flow, is suitable for field use, and with only two interchangeable tubes can measure permeabilities having a ratio of $1 : 10^6$, using test times of 3–30 min. The construction of the sample holder is described in detail. V. B.

624. Determination of Organic Peroxides. Evaluation of a Modified Iodometric Method. C. D. Wagner, R. H. Smith, and E. D. Peters. *Anal. Chem.*, 1947, **19**, 976.—An iodometric method (NaI in *iso*propyl alcohol) for peroxide determination has been modified and extensively tested. It accurately determines peroxides present in autoxidized olefins, but, in common with all other methods, it gives only empirical results when applied to peroxides formed in conjugated diolefins. Experiments proved

that under the conditions of the method iodine does not add to mono-olefins, and that in the absence of peroxides it does not add to conjugated diolefins. The method is more accurate and more widely applicable than iodometric methods employing acetic acid as solvent. G. R. N.

625. Evaluation of Piston Skirt Deposits. A. C. Scholp, B. J. Conta, and C. D. Russell. *Anal. Chem.*, 1947, **19**, 466.—Three methods for the measurement of soluble piston deposits are described: a magnetic thickness-gauge method applicable to pistons of magnetic material, a weight-difference method, and an acetone solution method. The two former methods give accurate measures of soluble piston deposit thickness and weight, respectively. The third method, while less accurate is also applicable to other engine parts and enables the deposit to be collected for further study. For routine evaluations the weight-difference method is most suitable. For the measurement of insoluble piston deposits, a sectioning method and a voltage break-down method may be used, the latter suitable for routine evaluation provided proper calibration is obtained with the type deposits to be measured. G. R. N.

626. Polarographic Determination of Naphthalenes in Petroleum Fractions. R. A. Burdett and B. E. Gordon. *Anal. Chem.*, 1947, **19**, 843.—A polarographic procedure for the determination of naphthalenes in petroleum fractions is based on the reduction of condensed-ring bicyclic hydrocarbons at high negative potentials (− 2·51 volts S.C.E.). Monocyclic aromatics, paraffins, naphthenes, and mono-olefins do not interfere. Higher polynuclear aromatics interfere, but can usually be removed by distillation. G. R. N.

627. Quantitative Determination of Di*cyclo*pentadiene. F. Bergmann and H. Japhe. *Anal. Chem.*, 1948, **20**, 146.—The method consists of addition of formic acid to one of the double bonds and determination of the saponification equivalent of the resulting formate ester. The method is also applicable to the analysis of higher polymers of the hydrocarbon. G. R. N.

628. Raman Spectra of Hydrocarbons. M. R. Fenske, W. G. Braun, R. V. Wiegand, D. Quiggle, R. H. McCormick, and D. H. Rank. *Anal. Chem.*, 1947, **19**, 700.—The Raman spectra of 172 pure hydrocarbons are presented, both as reproductions of the original records obtained from a recording spectrograph and in tabular form as scattering coefficients and depolarization factors. Data are presented for 76 paraffins, 32 naphthenes, 29 olefins, 3 diolefins, 30 aromatics, and 2 other hydrocarbons. Direct comparisons of spectra are possible because a uniform intensity scale has been used. The spectrograph employed records the Raman spectrum as a graph with co-ordinates linear in both wave length and intensity. Raman spectra can be used for the qualitative and quantitative analysis of hydrocarbon mixtures. A few nine-component mixtures have been analysed successfully. In general, Raman spectroscopy in hydrocarbon analyses is best used as a complement to, rather than a substitute for, the infra-red and ultra-violet techniques. G. R. N.

629. Correlation of Intensity Measurements in Raman Spectra obtained with Different Instruments. D. H. Rank. *Anal. Chem.*, 1947, **19**, 766.—The chief sources of error in intensity measurements in Raman spectra for analytical purposes are discussed. Three of the major causes of discrepancies between observations of different operators using different instruments are treated and suggestions are made for minimizing these errors. The variation in apparent intensity caused by variable polarization of Raman lines and widely different transmission factors for plane polarized light for different spectrographs is discussed in detail. Equations are derived to enable polarization corrections to be made to the "scattering coefficients" tabulated in the catalogue of hydrocarbon spectra by Fenske and his collaborators. By means of given curves scattering coefficients given in the catalogue can be calculated approximately as they would be observed in other spectrographs if the transmission factor for the two kinds of plane polarized light is known. G. R. N.

630. Semimicro Analysis of Light Hydrocarbon Mixtures by Multi*iso*thermal Distillation. R. S. Echols, Jr., and E. Gelus. *Anal. Chem.*, 1947, **19**, 668.—A method is presented for the analysis of light hydrocarbon mixtures containing hydrogen, nitrogen, and the

olefinic and paraffinic hydrocarbons through the butanes. The method is based on a controlled vaporization of the sample, and is comprised of two complementary techniques referred to as *iso*thermal and multi*iso*thermal distillation. The first is designed specifically for the analysis of mixtures of propane, *iso*butane, *n*-butane, and *iso*pentane, and requires a gaseous sample of 2 ml at N.T.P. The second embraces the remaining components and requires a gaseous sample of about 50 ml at N.T.P. An overall accuracy of about ± 1 percentage unit may be obtained. G. R. N.

631. Shale Oil Naphthas. G. V. Dinneen, C. W. Bailey, J. R. Smith, and J. S. Ball. *Anal. Chem.*, 1947, **19**, 992.—A method for the analysis of small samples of shale-oil naphthas is based upon the selective adsorption of the various classes of compounds by silica gel. Data are presented on adsorbability of various classes of hydrocarbons, sulphur compounds, and nitrogen compounds. For best results, the tar acids and bases should be removed before analysis. G. R. N.

632. Determination of Sulphur by Combustion in a Vertical Tube. D. B. Hagerman. *Anal. Chem.*, 1947, **19**, 381.—A method is described wherein sulphur is determined in a wide range of organic liquids by allowing the sample to drop into a vertically held tube containing a bed of hot porous material. The resulting sulphur gases are drawn from the lower end of the tube, and are absorbed in a solution of hydrogen peroxide in which the sulphur is determined alkalimetrically. The method does not apply to compounds which contain nitrogen, phosphorus, the halogens, barium, calcium, or any metals which form stable compounds with sulphur at 1500° F. It does not apply in its present form to low-gravity hydrocarbons of the nature of gasolines. G. R. N.

633. Determination of Tetraethyl-lead in Aviation Gasoline. L. Newman, J. F. Philip, and A. R. Jensen. *Anal. Chem.*, 1947, **19**, 451.—An iodometric method for the determination of tetraethyl-lead in aviation gasoline is presented. The fuel is shaken with an excess of alcoholic potassium triodide solution which reacts with tetraethyl-lead; interferences due to olefins and aromatic amines are minimized, if necessary, by previous extraction with 70% (by vol) sulphuric acid. The excess iodine is titrated with sodium thiosulphate. The method requires about 15 min for two concurrent determinations on the same fuel. It is applicable to all aviation gasolines that are in current use, and has a maximum deviation of $\pm 0{\cdot}05$ ml of tetraethyl-lead per U.S. gal when it is compared with A.S.T.M. results. G. R. N.

634. New Thermometric Standard. Anon. *Petrol. Engr*, Dec. 1947, **19** (3), 158.—Some information is given regarding a new thermometric standard utilizing the freezing point of benzoic acid as a fixed temperature. The acid is contained in a suitable cell and these can be used to calibrate platinum resistance thermometers and thermocouples at a temperature near 100° C more rapidly than is possible with the boiling point of water. The temperature provided by the cell is virtually the triple point of benzoic acid (122·362).

One reference is given. R. B. S.

635. Measuring the Volumetric Expansion of Solid Materials. W. W. Pendleton and H. M. Philofsky. *Anal. Chem.*, 1947, **19**, 406.—A method for measuring the coefficient of cubical expansion of solid materials is described. Similar in principle to the A.S.T.M. test for the volumetric expansion of bituminous materials, it presents modifications in both apparatus and procedure, which allow use of laboratory equipment and shorten time of testing. Both expansion and contraction may be measured. G. R. N.

Crude Oil.

636. Composition and Properties of Petroleum in West Virginia. A. J. W. Headlee, R. E. McClelland, and H. A. Hoskings. *Producers' Monthly*, Oct. 1947, **11** (12), 33.—This paper is the second report regarding the determination of the composition and properties of West Virginia petroleum (for first report see Abstract No. 119 [1948]). In this part further extensive data are presented in tabular form of the fractional-distillation analysis and aromatic content of West Virginia petroleum samples. Data

are also given of the sulphur content, specific gravity, refractive index, refractivity intercept, and surface and interfacial tensions of the various aromatic extracts.

R. B. S.

637. Elimination of Water from Wet Crude Oil by the Hot Water Washing Process. K. A. Clark and D. S. Pasternack. *Canad. Chem. & Proc. Industr.*, Nov. 1947, **32** (11), 1007; Jan. 1947, **33** (1), 32.—*Part I, Continuous Settling at Atmospheric Pressure.* The established process for the recovery of oil from Alberta bituminous sand involves washing with hot water which produces a crude oil of high water content in the region of 40%, containing up to 5% of mineral matter. Removal of water from this crude product by evaporation has proved quite unsatisfactory, due primarily to the unmanageable froth which is produced on heating and, secondarily, to the abrasive action of the residual sand upon parts of the evaporation equipment. When this fact had been established, attempts were made to produce the required result by a settling process at elevated temperature under atmospheric pressure.

After several unsuccessful experiments a continuous 3-stage settling procedure carried out in the region of 180° F was established, using as feed the wet crude diluted with kerosine or dry oil.

By this method it was found possible to reduce the water content of the oil to about 12%, but further reduction was found impossible. It was therefore decided that an alternative or supplementary process would be necessary.

Part II, Continuous Settling under Pressure: Evaporation. In this investigation, several types of equipment were used, but owing to the high degree of dispersion of approximately 20% of the water, no improvement was achieved, even when temperatures of up to 323° F were used.

Following this work it was found that, in contrast to the disadvantages encountered with the evaporation of the wet crude oil, there was no difficulty in evaporating water from the wet diluted oil emanating from the continuous settling process under atmospheric pressure. If this feed stock is used and is run into dry oil at suitable temperature, the residual water flashes off and dry oil, which is suitable for charging to refineries, remains.

O. M.

Lubricants.

638. Patents.—Socony-Vacuum Oil Co. Inc. B.P. 597,338, 4.2.48. Mineral oil composition.

639. Vigzol Oil Refining Co. and T. Kennedy. B.P. 597,463, 11.2.48. Preparation of E.P. lubricants.

G. R. N.

Derived Chemical Products.

640. Manufacture of Ethyl Alcohol from Petroleum. R. S. Aries. *Chim. et. Ind.*, 1948, **59**, 231–235.—Direct hydration of ethylene is exothermic and equilibrium is favoured by low temp and high pressure; excess of pressure, however, causes (at low temp) condensation of the water and (at high temp) polymerization of the ethylene. At 200° C and 21 kg/cm², with a water–ethylene ratio of 2, equilibrium corresponds to 20% of EtOH; and catalysts are required to accelerate the reaction. At least one industrial plant of this type is planned. The sulphuric-acid process allows of almost theoretical yields; the problem of dilute-acid disposal can be overcome by a process using weak (8%) sulphuric acid at 42–70 kg/cm² and 250° C. This has not yet been used industrially, largely owing to corrosion difficulties that would be experienced. Using the strong (>90%) acid process silver sulphate is the best catalyst. Yields of 70–80% can be obtained from gases containing only 30% of ethylene whilst richer gases allow of a total conversion of up to 90% (including *ca* 5% of diethyl ether). A description of this process, with flow diagram, is given. With crude at $1·75/brl, ethanol can be produced for $0·15/gal.

V. B.

641. Patent.—Dominion Tar and Chemical Co. B.P. 598,068, 25.2.48. Diaryl paraffins and their production.

G. R. N.

Miscellaneous Products.

642. Insecticidal Emulsions ; Easier to Ship, Safer to Use. G. A. Mail. *Chem. Ind.*, Feb. 1948, **62** (2), 238.—The advent of new and more effective toxicants such as D.D.T., Chlordane, Toxaphene, and Gammexane for use as insecticides has greatly increased interest in the aqueous-emulsion sprays since, in oil solution, these new products are toxic to higher animals and plants.

In early practice the aim of spraying was to hit the insect with drop of the toxic spray, since it was only effective by absorption, but these new insecticides are now known to be true contact poisons and, therefore, are effective in residual sprays.

Stability of insecticidal emulsions is very important, and in this connexion it has been shown that, in many cases, combinations of water-in-oil and oil-in-water emlsifiers are very effective. Emulsion concentrates of D.D.T. (*i.e.*, concentrated dispersions of D.D.T., containing a relatively large quantity of emulsifier and wettable powders, which can be diluted by the user) are now on the market and simplify the problems of packaging and shipment. Chlordane has the added advantage of being soluble in paraffinic solvents, so that kerosine can be used as a solvent, though it does show a tendency towards increase in acidity during storage. This latter fact is obviously serious from the packaging aspect, though not from the biological one, since the toxic properties of Chlordane do not deteriorate with decrease in pH.

The chlorinated Camphene, Toxaphene, also shows promise for the future due to the ease with which its emulsions can be prepared, particularly since it can be heated to 100° C without break-down or loss of biological effectiveness.

Benzene hexachloride, or Gammexane as it is sometimes called, whose toxic properties are wholly concentrated in its gamma isomer, is another very effective insecticide whose concentrate yields diluted emulsions of sufficient stability for use in the field.

The advent of new emulsifiers will widen the scope of these new insecticides considerably, though, in general, emulsifiers of the non-ionic type, which are not affected by the presence of inorganic salts, would appear to be the most promising at the moment. O. M.

643. Patents.—T. O. Wilton. B.P. 597,449, 11.2.48. Processes and plant for the manufacture of pitch.

644. T. Swan & Co. B.P. 597,739, 11.2.48. Bituminous compositions.

645. N.V. de Bataafsche Petroleum Mij., J. F. T. Blott, and P. Alexander. B.P. 597,596, 11.2.48. Process for the manufacture of bituminous mixtures.

646. Anglo-Iranian Oil Co. Ltd., W. A. Partridge, and F. J. Patman. B.P. 597,872, 18.2.48. Petroleum fuel oils.

647. J. C. Arnold (Standard Oil Development Co.). B.P. 598,180, 25.2.48. Waterproof fibrous coating compositions. G. R. N.

Engines and Automotive Equipment.

648. Chromium Plating of Cylinders. J. P. Bolzaardt. *Ingenieur*, 27.2.48 (9), W23–26.—The deposition of a film of chromium on cylinders for I.C. engines by an electrical method is described, and it is shown that a chromed cylinder lasts 5–15 times as long as an unchromed cylinder.

Four microphotographs and an illustration of the chrome plating are included. N. C.

649. Diesel Locomotive Oil Filters. F. L. Townsend. *Diesel Pwr Diesel Transportation*, Dec. 1947, **25** (12), 72.—Cotton waste has been found satisfactory for filtering fuel and lubricating oil in diesel locomotive engines, as it has fine filtering qualities, a natural affinity for moisture, and does not affect any additives present in the oil. It is important that the filter be designed to utilize the entire amount of cotton for oil

filtering, and that there is no "channeling" of the oil through the waste. In this respect, the perforations of the centre discharge tube should stop some distance from the top and bottom of the cotton sock. The filters may be either of the full-flow or by-pass type, the latter being satisfactory if about 15–20% of the pump capacity can be fed to the filter.

It has been claimed that it is the most economical practice to discard the oil-filter recharge on diesel locomotives every two weeks. The considerable quantity of oil soaked up by the waste may be pressed out, refined, and used to lubricate other machines. The waste itself may be reclaimed by mixing it with wool waste to use for car journal-bearing lubrication, but as only small amounts may be used for this purpose, longer life recharges would still be of considerable advantage for diesel locomotive use. C. D. B.

650. Torque Converter Drive. Anon. *Diesel Pwr Diesel Transportation*, Dec. 1947, **25** (12), 64.—The torque converter drive, which has been fitted to the new Allis-Chalmers HD-19 diesel tractor, is a device for automatically balancing torque against speed to meet load. It is based on the principle of the fluid flywheel. The mechanism consists of three sets of blades combined in one wheel on a single shaft, the driving fluid striking one set of blades after another. The three stages consist of the impeller wheel, which is turning constantly, and is connected to the engine through the master clutch; the turbine wheel having three sets of blades connected to the transmission by a short splined shaft; and the outer wheel of reaction blades.

When rotating, the fluid is thrown away from the impeller, and in exerting its turning effect on the turbine blades, it is reversed in direction three times by reaction between the rows of driven blades and the reaction blades. The torque is thus in effect multiplied three times. An increase in load alters the angle at which the fluid strikes the blades, thus slowing down the driven member; the increase in torque which is then necessitated is automatically provided as the fluid strikes the blades at a sharper angle.

The chief advantages of the torque converter are its smooth powerful operation and its ability to prevent the transmission of shock loads to the engine. C. D. B.

651. Patent.—Anglo-Saxon Petroleum Co., Ltd. and I. F. S. Robinson. B.P. 598,084, 25.2.48. Apparatus for determining the distribution of anti-knock constituents on a fuel among the cylinders of an I.C. engine. G. R. N.

MISCELLANEOUS.

652. Volume of Laboratory Fractions. W. L. Nelson. *Oil Gas J.*, 19.2.48, **46** (42), 133.—Fractions from laboratory distillations are collected at a different temperature from that at which the still was charged.

A table is given in No. 184 of the Refiner's Notebook series, showing the number of cc to be added to or subtracted from 100 cc fractions collected at various temperatures in such distillations. G. A. C.

653. Wells of Distinction. E. Adams. *Petrol. Engr*, Nov. 1947, **19** (2), 47.—A review is presented of wells of some historical interest and significance. R. B. S.

654. Patents.—Shell Development Co. B.P. 597,798, 18.2.48. Flaw detector for electrically conducting tubular elements.

655. Anglo-Iranian Oil Co., Ltd., A. P. Shearer, L. B. Witten, and T. Cubin. B.P. 598,302, 25.2.48. Breaking of emulsions.

656. C Arnold (Standard Oil Development Co.). B.P. 598,322, 25.2.48. Stabilization of synthetic rubber lattices. G. R. N.

BOOK REVIEW.

The Elements of Fuel Technology. G. W. Himus. London: Leonard Hill Ltd., 1947. Pp. 506 + xvi. 42*s*.

In this book Professor Himus presents the principles underlying fuel technology and gives a short, simple and yet clear outline of many of the problems involved in the proper utilization of fuel, illustrated by reference to examples taken mainly from British practice. Solid, liquid, and gaseous fuels are dealt with, but the main emphasis, as only to be expected in a general book on the subject, is upon coal and fuels derived from coal.

The introductory chapter, concerning fuels generally, is followed by chapters on the origin and formation of coal, Britain's resources of coal, "industrial" coals, Britain's requirements of coal and how they are employed, storage of coal, and combustion of coal. Then follow chapters on steam-raising, pulverized coal and oil-coal mixtures, steam on the works, coal as a source of derived fuels, the gas industry, the coking industry, low temperature carbonization, producer gas, water gas, coal as a source of liquid fuels, liquid fuels, fuel oil and its combustion, gaseous fuels and their combustion, fuel economy in furnace practice, domestic heating.

The subjects included cannot, in the compass of a relatively small volume, be dealt with in detail, but the elements are adequately and, in most cases, well covered; references at the end of each chapter indicate where more detailed information on particular topics may be found. The sections on sulphur in coals, steam raising, boiler management, steam on the works, producer gas and water gas are particularly well dealt with. So also is the section on the combustion of coal, although it is a little surprising to find that the "atomic chain" theory of the oxidation of gaseous hydrocarbons is mentioned merely in a footnote. The section dealing with coal cleaning would have been improved if some of the space devoted to the obsolescent Elliott washer and to the calcium chloride process had been devoted to, say, the Barvoys process, which is even omitted from the table showing classification of coal-cleaning process (although less well-known processes, such as the Ougrée, are included); in this table the Loess process is wrongly classified under froth flotation.

In the section on heat transfer from flames and hot gases, the work of McAdams, published in 1942, is not mentioned; this may be because the manuscript was prepared before the end of 1943, a fact which, no doubt, accounts for what, in 1948, seem to be omissions in the sections on combustion of hydrocarbons and gasification of coal.

The book may be recommended as a very good introduction to the subject, especially as it is written in a style which, coupled with good printing and clear illustrations, makes it a delight to read.

S. G. W.

BOOKS RECEIVED.

Physical Constants of Hydrocarbons. Vol. IV. Polynuclear Aromatic Hydrocarbons. Gustav Egloff. New York: Reinhold Publishing Corpn., 1947. Pp. 540 + xi.

This fourth volume in the series on physical constants of hydrocarbons is a collation and evaluation of the physical constants of polynuclear hydrocarbons. The compounds included are fused-ring hydrocarbons having at least one aromatic ring.

Secondary Recovery of Petroleum in Arkansas—A Survey. George H. Fancher and Donald K. Mackay. El Dorado, Arkansas: Arkansas Oil and Gas Commission, 1946. Pp. 264 + ix.

This reports the results of a survey and study of the prospects for the secondary recovery of petroleum in the oilfields of South Arkansas. Starting in 1943 pertinent data covering each field has been collected, studied, and incorporated in tables, graphs, and maps. All data have been critically examined with regard to secondary recovery possibilities.

Comprehensive Index of the Publications of the American Association of Petroleum Geologists, 1917–45. Daisy Winifred Heath. Tulsa, Oklahoma: A.A.P.G., 1947. Pp. 603.

1947 Supplement to Book of A.S.T.M. Standards. Pt. I-A. Ferrous Metals. Pp. 405 + xiii. **Pt. III-A. Non-Metallic Materials—Fuels, Petroleum, Aromatic Hydrocarbons, Soaps, Water, Textiles.** Pp. 437 + xiii. **Pt. III-B. Non-Metallic Materials—Electrical Insulating Plastics, Rubber, Paper, Shipping Containers, Adhesives.** Pp. 305 + xiii. Philadelphia, Pa: American Society for Testing Materials, 1947.

German Intelligence Reports.

B.I.O.S.

985. Separation of Methane and Ethane from Coal Gas. Pp. 23.

1610. Fundamental Work on Friction, Lubrication, and Wear in Germany. Pp. 59.

1653. German Oil-Burning Devices Industry. Pp. 38.

1697. Synthetic Oil Production in Germany. Interrogation of Dr. Bütefisch. Pp. 26.

1706. Polymerization of Ethylene with Special Reference to High-pressure Design and Techniques. Pp. 24.

1708. Production of Butane-1 : 2 : 4-Triol at I.G. Ludwigshafen. Pp. 37.

1725. Synthetic Aromatics, Perfumes, Isolates, and Their Derivatives. Pp. 95.

Misc. 60. Synthesis of Hydrocarbons and Chemicals from CO and H_2. Pp. 128.

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Oilfield Exploration and Exploitation.

Geology.

657. Zones of Plattin-Joachim of E. Missouri. J. G. Grohskopf. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **3**, 351–365. Examination of cable-tool cuttings from water-wells has led to the establishment of four zones in the "Plattin" and two in the "Joachim," based on lithology and insoluble residues. A cross section through 14 wells stretching 300 miles from northeast to southeast Missouri indicates the thickness and position of the zones present.

In southeast Missouri the "Plattin" is 600 ft thick and the "Joachim" 250 ft thick, while 75 miles northwest the thicknesses are 200 and 175 ft respectively. In northeast Missouri, near Kirksville, both formations are overlapped by the "Decorah," where the latter rests on St. Peter. Older beds are overlapped from southeast to northwest and suggest unconformity at the "Decorah" base.

Some subsurface zones have been located at the outcrop at widely separated localities. The "Plattin-Joachim" boundary and the term "Decorah" need definition. E. N. T.

658. Reservoir Study of the West Edmond Hunton Pool, Oklahoma. M. Littlefield, L. L. Gray, and A. C. Godbold. *Petrol. Tech.*, Nov. 1947, **10** (6), *A.I.M.M.E. Tech. Pub. No.* 2203, 1–25.—Studies of the producing sector of the Hunton reservoir rock at West Edmond have been shown that about 90% of the pore volume is intergranular and some 10% intermediate (fracture porosity). The porous limestone is divided into blocks by fractures. Fractures are less well developed in the strongly dolomitic parts.

The low-permeability intergranular porosity, which is largely subsidiary to the high-permeability fractures, will produce into the latter by gas-evolution from solution. The fractures serve as drainage channels for the removal of oil from the intergranular pores. Because of the marked differences in the intergranular and intermediate permeabilities there will be extensive by-passing, and it is doubtful whether full-scale high-pressure gas injection would be technically and economically satisfactory.

The field is a west-dipping monocline on the west flank of the "granite" ridge. Pennsylvanian rests unconformably on Mississippian and older rocks. The pool is bounded by wedging out to the east and north, and by edge-water in the west. The producing area exceeds 29,000 acres, and up to September 15, 1946, 53,000,000 brl of oil had been produced from 731 wells averaging 6900 ft in depth. The closure is 560 ft. The initial reservoir pressure was 3145 p.s.i.a. and the saturation pressure about 2770 p.s.i.a. The original dissolved gas was 1010 cu. ft/brl, and the oil gravity 41° A.P.I.

The average producing gas/oil ratios in September 1946 were 5600 cu. ft/brl. There are evidences of water advance from the west and the cumulative water production is 5,220,000 brl. Cumulative gas production is 122,500,000,000 cu. ft.

Detailed data are given on porosities and permeabilities, and the reservoir performance is discussed. G. D. H.

659. Present Methods of Oil Prospecting. J. Mokrzyński. *Nafta*, Jan. 1948, **4**, 6–8.—Considers relative merits of four different plans for oil prospecting, that most favoured being one developed on the basis of "Statistical Methods," 1946, by G. Suldecor. M. S.

660. Petroliferous Provinces of U.S.S.R. F. J. Fohs. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **3**, 317–350.—Out of 8,390,000 miles of land and inland sea area in the U.S.S.R., 3,600,000 sq. miles are possibly oil-producing. There are 400,000 sq. miles of continental-shelf area.

Production to the beginning of 1947 (inclusive of Sakhalin) was 5,722,000,000 brl and in 1946 166,000,000 brl of crude oil were produced. U.S.S.R. known reserves are 8 billion brl compared with U.S.A. known reserves of 24 billion brl.

Russia has only 14,000 oil wells, while the U.S.A. has 424,000. Under Soviet control are areas covering 427,000 sq. miles, including the Hungarian and Rumanian basins inclusive of the Sub-Carpathian region and covering 130,000 sq. miles of prospective oil territory. The reserves here are estimated as somewhere between 241,000,000 and 491,000,000 brl, with estimates for Rumania of from 150,000,000 to 400,000,000 brl.

The estimate of the exploitable oil areas of the U.S.A. is 1,400,000 sq. miles, with a potential production of 100,000,000,000 brl. Equivalent sedimentary areas in the U.S.S.R. contain a potential 33,000 million brl, of which only 6,000 million brl have been produced and 8,000 million brl proved.

The Soviet Union has within its own borders an estimated oil reserve of 150–160 billion brl, which may possibly amount to 180–190 billion brl. Including resources under its control, it dominates more than a third of the world's ultimate oil reserves. E. N. T.

661. Drilling on Bikini Atoll, Marshall Islands. H. S. Ladd, J. I. Tracey, and G. G. Lill. *Science*, 1948, **107**, 51.—During the resurveying of Bikini Atoll (Operation Crossroads) in the summer of 1947, five holes totalling 4510 ft were drilled on Bikini Island. Rotary drilling was used. One of these holes has a depth of 2556 ft and is the deepest yet drilled on a Pacific coral island. Nothing but calcareous sediments was encountered and these were mostly unconsolidated or poorly cemented. Tertiary rocks were observed from a depth of 925–935 ft, but the top of the system may lie much higher. Description of drilling operations, results of geological and geophysical observations, and suggestions for additional work are given. J. T.

Geophysics and Geochemical Prospecting.

662. Radio-activity Well Logging. E. N. Tiratsoo. *Petroleum*, Jan. 1948, **11**, 2.—Theory and methods for the differentiation of the strata traversed by a borehole on the basis of their varying radio-active properties. The gamma and neutron logs are described. F. W. H. M.

Drilling.

663. Drilling Technology Progress. J. E. Kastrop. *World Oil Yearbook*, 1948, **127** (11), 124.—Recent progress in drilling technology is reviewed under the following headings: (1) new drilling methods; (2) oil-well cementing; (3) oil-well surveying; (4) drilling fluids; (5) reverse circulation; (6) cutting and fishing; (7) rotary-bit design; (8) weight and torque control; (9) power transmission and couplings; (10) hoisting equipment; (11) electric rigs; (12) drilling strings; (13) pressure control; and (14) mud systems. No references are given. R. B. S.

664. Mechanical Problems in Deep Drilling. J. I. Morris. *World Oil*, Feb. 1948, **127** (10), 69.—The author discusses the mechanical requirements of rig equipment, drill pipe, casing, etc., imposed by deep-drilling practices. Two references are appended. R. B. S.

665. Modern Methods Speed Hugoton Completions. V. J. Mercier. *World Oil*, Nov. 1947, **127** (7), 167.—The completion practices adopted in the Hugoton gas field extend-

ing from Texas to Kansas are described. Most of the wells are tested by radioactivity logging methods and are completed by gun perforating with selective acidizing. Two methods of selective acidizing are in general use: the first method employs the drillable bridging plug, whilst the second method utilizes conventional packers. Both methods are described and illustrated by means of diagrams. Diagrams of gamma ray and neutron logs of one of the wells are also presented.

One reference is appended. R. B. S.

666. Casing Strain after Cementing. H. G. Texter. *Oil Gas J.*, 8.4.48, **46** (49), 72.—In the past there has been no generally accepted standard for the amount of strain that should be left in the casing at the time of landing it in the casing head. More recently it was proposed that casing should be neither in tension nor compression at the freeze point. This proposal requires several assumptions: (1) that there will never be any temperature change in the casing after the heat of reaction of the cement has been dissipated; (2) there will never be any pressure changes inside the casing; (3) the freeze point can be determined accurately; (4) there is danger of casing failing in tension at high loads; (5) that casing joints are less resistant to leakage under high-tension loads than lower ones. These assumptions are discussed. The author suggests that the safe procedure is to land the casing in the casing head at exactly the position in which it was hanging on the hook when the cement plug hit bottom. A short discussion is appended. C. G. W.

667. Safety Factors in Casing Design. E. N. Kember. *World Oil*, Jan. 1948, **127** (9), 71.—The exact meaning of safety factors and the manner of their selection are first discussed. The basis of present practices in determining safety factors for collapsing, bursting, and tensile loading is then reviewed and the type of information that is required to keep safety factors, and hence well costs, to a minimum, is indicated. Five references are appended. R. B. S.

668. Effect of Hole Enlargement on Cementing and Completion. B. Barkis and K. A. Wright. *World Oil*, Dec. 1947, **127** (8), 109. (*Paper presented before American Association of Oil Well Drilling Contractors, Long Beach, California*, October 1947.)—Drilling costs are related to the amount of material excavated, whether this be due to intentional or unintentional enlargement. Holes drilled to gauge will therefore tend to be more economical as well as to reduce cementing and completion failures. The nature of the drilling fluid influences the tendency for sloughing or caving to take place and the possibility of sticking drill pipe or having a very difficult fishing job is more remote when a drilling fluid has been selected which will maintain the drilled hole closely to bit diameter. Six references are appended. R. B. S.

669. Cementing Method to Prevent Cement Contamination in Casing. G. Weber. *Oil Gas J.*, 26.2.48, **46** (43), 134.—One investigator contends that the conical or tapered flow in conventional cementing equipment causes deformation of the rubber plug separating slurry and mud, hence causing contamination. To eliminate this a float shoe with a disengaging float assembly was designed to give full-bore discharge. Additional equipment used to effect cementing in this manner consists of a collapsible cementing plug designed to provide an unbroken seal and a stall collar to prevent slurry backflow. Equipment and procedure are described and illustrated.

C. G. W.

670. Strength and Elasticity of Long Tubular Columns Used in Drilling Deep Wells. J. P. Bernhard. *Bull. Ass. franç. Tech. Pétrol.*, 1.12.46 (60), 63.—This paper is an exhaustive mathematical analysis, with tables, graphs, and diagrams of the problems occurring in handling long strings of drill pipe and casing. Three main problems face the operator in actual drilling practice: (1) development of an efficient drilling tool; (2) efficient power transmission to this drilling tool; (3) removal of cuttings. It is with the second of these problems that the author concerns himself, dealing with previous work as well as original observations and deductions.

The paper is dealt with in three parts. (1) Problems common to strings of rotary drill pipe and casing and special problems concerning each of these. (2) Studies the

inertia effects and resonant vibrations set up by rotation. (3) Studies the resistance of the column to failure by fatigue.

Part 1. 1. Equilibrium under tensile and compressive forces: (*a*) column of uniform cross section; (*b*) of variable cross section; (*c*) of casing and problems of cementing; (*d*) modifications due to mud circulation. 2. Axis of the column not vertical. Study of yielding of the column and the effect of mud on yielding. 3. Effects of torsion: (*a*) torsion alone; (*b*) general case. 4. and 5. Strength of a column subjected to tension, torsion, and fluid pressure. 6. Yielding under torsion.

Part 2. The dynamics of a long vertical hollow column immersed in a liquid and subjected to a uniform rotary motion. This deals with longitudinal torsional and transverse oscillations, and modifications due to the effects of drill collars, tool joints, presence of mud, and centrifugal force. General conclusions on vibrations.

Part 3. 1. Possible methods of rupture. 2. Experimental determination of the resistance of A.P.I. joints to fatigue failure. 3. Phenomenon of corrosion. 4. Study of several improved joints. 5. Proper use of rotary drill rods. Selection of equipment. C. G. W.

671. Unitized Cable Tool Dump Boxes. G. M. Wilson. *World Oil*, Jan. 1948, **127** (9), 65.—Several methods of improving dump-box performance which assist in reducing hole-making time are outlined. Methods of adapting the necessary equipment to existing cable-rig installations are also suggested. R. B. S.

672. Bailey Bridge Adapted to Wild Cat Drilling. E. Short. *Oil Gas J.*, 4.3.48, **46** (44), 68.—The use of the Bailey Bridge as a floating and loading ramp for moving trucks to and from drilling barges, is described and illustrated. C. G. W.

673. New Drilling Barge. E. Short. *Oil Gas J.*, 11.3.48, **46** (45), 77.—Shell's new steam-powered drilling rig has a 185 ft derrick with a 952,000 lb A.P.I. rating, designed for drilling to 18,000 ft. The drill barge is 152 ft × 54 ft × 14 ft. Salient features are discussed and illustrated. C. G. W.

674. Marine Drilling Platform. D. M. Duff. *Oil Gas J.*, 18.3.48, **46** (46), 123.—This platform, one of the largest yet constructed, is in 50 ft of open water in the Gulf of Mexico 7 miles off shore. Gross weight of the structure and equipment is 5000 tons and is designed to withstand winds up to 120 m.p.h. and a wave height of 35 ft. The two decks measure 110 ft × 206 ft, and up to seven holes may be drilled from the one structure. Details of construction are given. C. G. W.

675. Applications of Driscose in Drilling Muds. J. R. Pettigrove. *World Oil*, Nov. 1947, **127** (7), 135.—The applications of Driscose as a colloidal agent in drilling-mud systems is discussed. Driscose is a sodium carboxymethylcellulose which exists as a white powder and is claimed to be immune from chemical and bacterial action. Laboratory and field tests show that low water loss and thin filter cakes can be attained with this additive, and that these properties are unaffected by foreign materials such as salt, anhydrite, or cement. R. B. S.

676. Use of Premixed Sodium Taunate Solutions. J. T. Clarke and L. R. Surber. *World Oil*, Dec. 1947, **127** (8), 114.—The use of caustic soda and quebracho is well recognized as an established procedure in conditioning drilling fluids. These materials are usually obtained in the dry form and mixed at the well head. There are, however, several disadvantages in this method, and these are discussed. The use of a premixed concentrated solution of these two materials is suggested as an alternative. R. B. S.

677. Penetration of Drilling Muds into Porous Beds from Wells made by Rotary Drilling. M. Gawliński. *Nafta*, Jan. 1948, **4**, 16, 17, 18, 25.—Criticizes, point by point, an article on the same subject by Z. Obuchowicz in the October 1947 issue of *Nafta*. It is argued that penetration does not depend on the pressure of the mud and supports this by:

(1) Mathematical theory outlined by P. A. Rebinder (published as a part of a

work "New informations regarding clays and drilling muds used in drilling for petroleum," Moscow 1940):

$$v = \frac{k\Delta p}{\mu} \times \frac{1}{m}$$

where $v = \frac{dQ}{dt}$ = velocity of penetration, k = coefficient, Δp = press. diff., $m = \frac{Q}{\phi}$ = mass of mud deposited in time to Q = vol. of water, ϕ = dilution = $\frac{1}{\text{concent.}}$. Since Q = volume of water which penetrated $m \propto \Delta p$.

By integration $Q^2 = 2at$ where $a = \frac{k^1\phi}{\mu}$ = constant.

(2) Experiments published in an article by S. Gill, *A.P.I. Bull. No.* 209, 1932; (3) Experience in the field. Deterioration of walls is not due to penetration by muds, but often to carelessness of the crew. Any migration of mud is due to its inferior qualities and cracks in formation. M. S.

678. Application of Internal Combustion Engine Power to Rotary Drilling Rigs. W. S. Crake. *World Oil*, Nov. 1947, **127** (7), 107.—See Abstract No. 26 (1948).

679. In-line Mounting Simplifies Pump Set-up and Piping. M. H. Pearce. *World Oil*, Feb. 1948, **127** (10), 76.—Methods of installing mud-pumps at drilling locations are discussed. R. B. S.

680. Application of Pumping Equipment. K. N. Mills. *World Oil*, Feb. 1948, **127** (10), 119.—The various factors which affect the selection of pumping equipment are discussed, and the necessary formulæ and charts are presented. The utilization of information obtained by dynamometer testing is also discussed. R. B. S.

681. Unitized Rig Equipment Cuts Installation Operating Time. G. M. Wilson. *World Oil*, Nov. 1947, **127** (7), 128.—A description is given of several combinations of rig equipment which lead to reduced equipment handling, lower installation times, and better protection to auxiliary apparatus. R. B. S.

682. Airplanes Cut Drilling Costs. Anon. *World Oil*, Dec. 1947, **127** (8), 96.—The use of aeroplanes in solving supply problems in drilling operations is discussed. R. B. S.

683. Patent.—Grant Oil Tool Co. B.P. 599,057, 17.3.48. Determination of well-pipe perforations. G. R. N.

Production.

684. Chemical Removal of Clays. P. H. Cardwell. *Oil Gas J.*, 26.2.48, **46** (43), 130.—When HCl or $CaCl_2$ solutions contact mud cakes, a partial flocculation of the mud is effected by base exchange, increasing the permeability of the cake. Mud acid, a mixture of HCl and HF, dissolves and removes the mud cake. The solubility of sand formation in mud acid is much greater than in HCl and hence greater benefit is obtained by use of mud acid. The results of laboratory tests on mud cakes and formations with mud acid and HCl are given.

Clays used in water-base drilling fluids are classified into three groups: (1) Montmerillonite type $(OH)_4Al_4Si_8O_{20}nH_2O$; (2) Illite type

$$(OH)_4Ky(Al_4Fe_4Mg_4Mg_6)Si_{8-y}AlyO_{20},$$

$y = 1$ to 1·5; (3) Kaolinite type $(OH)_8Al_4Si_4O_{10}$. The structures and properties of these clays are dealt with briefly. C. G. W.

685. Condensate Production and Cycling. Part 9. P. J. Jones. *World Oil*, Oct. 1947, **127** (6), 174.—Pressure maintenance in condensate fields by gas injection below the water contact is discussed. The chief advantage in injecting gas on the down-dip side is that the breakthrough area for gas injected into water is greater than that for gas injection above a water contact.

Equations are derived for the purpose of determining: (1) the volume fraction of gas in production; (2) the volume fraction of water in production; (3) the cumulative gas production expressed as a multiple of the displaced water initially in place; (4) the gas–water ratio for the production from a uniformly permeable section; (5) the gravitational-pressure difference acting parallel to bedding in the up-dip direction; and (6) the invasion factor for injection wells located on the down-dip side of a water contact. Two references are appended. R. B. S.

686. Condensate Production and Cycling. Part 10. P. J. Jones. *World Oil*, Nov. 1947, **127** (7), 191.—The factors influencing the rate of rich gas production by expansion into wells are reviewed. Formulæ are presented for determining productive capacity under conditions of both uniform and declining production. A method of determining the approximate interference factor between wells is also described. One reference is appended. R. B. S.

687. Condensate Production and Cycling. Part 11. P. J. Jones. *World Oil*, Dec. 1947, **127** (8), 180.—The gas-producing rate through the tubing must be fast enough to entrain condensate and prevent liquid accumulating on the bottom when it would be lost by gravitational or capillary migration. Equations are presented for determining: (1) the necessary gas production rate; (2) the well-head pressure of producing well; (3) the average temperature in producing wells; and (4) the well-head pressure in injection wells. Two references are appended. R. B. S.

688. Condensate Production and Cycling. Part 12. P. J. Jones. *World Oil*, Jan. 1948, **127** (9), 136.—In this part the author discusses the composition of cycled production. The advantages and disadvantages of production by expansion and of production by cycling are also discussed, and a method is described for determining the most economical method of production: the use of this method is illustrated by three numerical examples. A method is also described for determining the probability and amount of condensation whilst cycling. R. B. S.

689. Benton Field Unit. W. L. Horner and E. G. Trostel. *Oil Gas J.*, 4.3.48, **46** (44), 77.—Unitization of the Benton gas-condensate reservoirs required: (*a*) geological engineering, (*b*) reservoir engineering. Problems were: (1) to determine the areal limits of economic production; (2) to determine the quantities of recoverable hydrocarbons; (3) to determine the equity in value of recoverable hydrocarbons underlying each tract.

Available data included: (1) survey of the area; (2) geophysical data, electric logs, core analyses, production tests, samples, etc.; (3) P.-V.-T. data on the reservoir fluid; (4) details of the proposed cycling plan; (5) plant economics, etc. The application of this data to the solution of the above problems is described in detail.

C. G. W.

690. Corrosion in Condensate Gas Wells. N. Hackerman and D. A. Shock. *World Oil*, Nov. 1947, **127** (7), 198.—Previous work on the problem of distillate-well corrosion is first reviewed, and a method of corrosion testing is described. Subsequent laboratory examination of corroded steel samples seems to indicate that in non-corrosive wells there is present in the liquid-hydrocarbon phase some polar organic materials which are absent in other wells. It is believed that these materials prevent local corrosion by reacting with the surface of the steel and producing an impermeable film. These compounds have not as yet been identified, but work is being continued on this phase of the problem.

Sixteen references are appended. R. B. S.

691. Corrosion Control in Mid-Continent Production. C. C. Munger. *World Oil*, Dec. 1947, **127** (8), 172.—Very difficult corrosion problems are encountered in the Mid-Continent fields, due to the combined action of hydrogen sulphide and salt water. The sulphate content of the water in this area also produces difficult problems due to the precipitation of a calcium sulphate or gypsum scale on tubing and sucker rods.

Two materials have recently been developed which have been compounded into coatings that have been found to successfully reduce corrosion effects in these fields.

The first is a thermoplastic vinyl resin: this has been compounded with various solvents, pigments, and modifying plasticizers to produce coatings which have shown a high resistance to hydrogen-sulphide corrosion over a period of years. The second material contains some phenolic synthetic resins which are thermosetting, and when applied properly provide a dense, hard coating with good corrosion resistance.

R. B. S.

692. Field Test of Corrosion Inhibitor for Low pH Flood Water. J. N. Breston and K. Barton. *Producers' Monthly*, Nov. 1947, **12** (1), 13.—See Abstract No. 276 (1948).

693. Practical Aspects of Cycling. M. G. Miller and M. R. Leuts. *Oil Gas J.*, 11.3.48, **46** (45), 106.—Gas cycling developed from two trends: (1) regulations eliminating flare gas; (2) recognition of retrograde condensation, suggesting that depletion of reservoir pressure may cause condensation in the reservoir. Plant processing is compared with stock-tank operations for condensate production, and a comparison made between recovery by natural depletion and by cycling, for rich and medium fluids. It should be realized that, depending on conditions, cycling may: (1) increase ultimate liquid recovery; (2) have little effect; (3) in some cases decrease recovery.

It is possible to predict into which category any reservoir may fall.

Conditions favourable for cycling are: (1) suitable wells available, and good geometry of the field; (2) sand conditions fairly uniform and structure good; (3) high condensate content of the gas, so that gas may be processed even after considerable dilution.

C. G. W.

694. Practical Aspects of Cycling. M. G. Miller and M. R. Leuts. *Oil Gas J.*, 18.3.48, **46** (46), 111.—This article reviews the economics of a cycling project. Items to be investigated before starting a cycling project are: (1) determination of wet gas in place; (2) properties and characteristics of the gas; (3) determination of flood pattern; (4) consideration of producing rate; (5) processing vs. stock-tank operation; (6) size of plant; (7) type of plant; (8) type of products; (9) plant efficiency. These factors are discussed, and the importance of unitization emphasized.

C. G. W.

695. Survey of Dual Completions. E. B. Miller. *World Oil*, Dec. 1947, **127** (8), 155. (*Paper presented before A.P.I. Chicago*, Nov. 1947.)—A review is presented of trends in dual-completion practices in the southwestern States of the U.S.A. The comparative advantages and disadvantages of dual completions in this area are also listed. It appears that in general in this area dual wells have no particular advantage over single completions from an operating viewpoint, and that all the advantages are either directly or indirectly related to the cheaper initial cost of development.

R. B. S.

696. Co-operative Pressure Maintenance Project. E. Short. *Oil Gas J.*, 12.2.48, **46** (41), 76.—The article reviews an example of gas conservation through co-operation in one field. 20 out of 21 companies agreed to contract to return reservoir gas to the sand.

C. G. W.

697. Electric Watchdogs for Small Gas Compressor. J. E. Kastrop. *World Oil*, Dec. 1947, **127** (8), 162.—Several electric devices are described which can be used for automatic control of gas compressors used in gas-lift operations.

R. B. S.

698. Selective Production. G. Weber. *Oil Gas J.*, 19.2.48, **46** (42), 107.—The article describes an alternate-layer method of gravel-packing wells. Following cleaning of the sand face, gravel is placed on bottom and a capped liner, slotted the length of the sand face, is run. Alternating layers of gravel and a sand–gravel mix are placed. For the mixed layers, sand of a size to give the same permeability as the producing formation is used. When the top layer reaches the top of the slotted-liner section, a plug of quickset cement is placed and a frangible guide run over the liner. When the plug sets the guide is broken, the plug checked for correct height, and a permanent guide is run around the top of the liner. To effect a positive shut off above the packer the annular space is filled with mud of suitable weight. An impermeable filter cake

is thus formed at formation face, upper and lower sand–gravel faces and liner slots opposite sand–gravel layers. Below the packer, fluid flow occurs from formation to tubing. When it is desired to move the packer, it is raised or lowered and impermeable filter cake may be broken down by a reversed pressure of 100 p.s.i.

Variations of the method permit gas and water shut-off and control of coning. Laboratory tests are described and the advantages of the method outlined.

C. G. W.

699. Pumping Equipment Applications. L. W. Fagg. *World Oil*, Nov. 1947, **127** (7), 170.—The use of dynamometer studies as an aid in reducing the lifting costs of wells produced by sucker-rod pumping is discussed. The various types of dynamometer cards which may be obtained are illustrated by several diagrams. One reference is appended. R. B. S.

700. Selection and Use of Sucker-Rod Pumps. R. L. Chenault. *World Oil*, Nov. 1947, **127** (7), 175.—The various factors involved in the selection and use of sucker-rod pumps are discussed in some detail. The types of operating conditions which are likely to be encountered in field practice are discussed, and suitable equipment and operating practices to meet particular conditions are suggested: problems which arise because of corrosion and of stretch of sucker rods and tubing are also discussed in this connexion. Necessary data for determining pump displacements with various size pumps, tubing, and sucker rods, and with either uniform or tapered-rod strings, is also presented. R. B. S.

701. Hydraulic Pumping System. G. M. Wilson. *World Oil*, Dec. 1947, **127** (8), 143.—A description is given of a hydraulic pumping installation which has been designed to re-equip certain older leases for additional production. R. B. S.

702. Combating Scale Formation. R. B. Walter. *World Oil*, Jan. 1948, **127** (9), 119.—The chemistry of scale formation is briefly discussed, and a description is given of an electrolytic method of combating scale formation. This method employs a metallic treating element which consists of alternate copper and zinc plates strung on to an iron rod and separated by brass spacer rings. This element is immersed in the fluid: the scale-forming constituents then attack the zinc and the resulting electromotive action precipitates the corroding scale and prevents its encrustation elsewhere. This method has been applied to oilfield emulsion treaters, boilers, pumps, rods, and tubing. R. B. S.

703. Electrical Models in Secondary Recovery Projects. A. Wolf. *Oil Gas J.*, 15.4.48, **46** (50), 94.—The electrical model is an electric conductor similar in shape to the oil or gas reservoir. Current is led into and out of the model by electrodes located at points corresponding to injection and producing wells. The currents are made proportional to injection and producing rates of the various wells. Quantitative results are obtained by measuring the electrical potential at various points in the model. The electrical-potential gradient is proportional to the pressure gradient in the reservoir, hence velocities and directions of flow in the reservoir may be predicted. If only semiquantitative results are required, a gelatinous model permits visual observation of the spreading of injected fluid by introducing coloured ions at the injection points.

To conduct a model study, an isopach map, corrected for variations in porosity and connate water, is required. Location of all wells, and, if present, of faults should be shown. Horizontal variation in permeability is neglected owing to lack of information; vertical variation is accounted for by a "displacement factor," usually about 80%.

In spite of the many simplifications, results are checked by practical experience remarkably well, particularly when questions of a comparative nature are to be answered. At present the method is applied mainly to the solution of cycling problems, but the potential applications are much wider. C. G. W.

704. Grain Size Determinations—A Tool for Secondary Recovery Operators. R. V. Hughes. *Producers' Monthly*, Nov. 1947, **12** (1), 10.—The experimental work which

has been done in determining grain-size distribution is reviewed. The utilization of the data obtained from these experiments is also briefly discussed. Seven references are appended. R. B. S.

705. Bottom Hole Separator Conserves Reservoir Energy. K. Kelley. *World Oil*, Oct. 1947, **127** (6), 163.—The importance of conserving reservoir gas, so that most of it is used for the primary purpose of moving oil into the well bore, is stressed; in most cases the ultimate recovery will be greater if artificial means are used to lift the oil to the surface at all times with a minimum volume of gas production. The operation of a bottom-hole separator suitable for installation with a sucker-rod pump is explained: this separator prevents free gas from entering the working barrel of the pump, so that only gas released from solution is produced at the well-head. Some details are given of oil and gas production before and after installation of this separator in several oil wells in the U.S.A. R. B. S.

706. Electric Power in Water Flooding. B. F. Thompson. *World Oil*, Oct. 1947, **127** (6), 181.—The use of electrical power for water pumping and other operations connected with water flooding is discussed. R. B. S.

707. Water-flood Spacing. S. T. Yuster. *Producers' Monthly*, Nov. 1947, **12** (1), 18; *World Oil*, Jan. 1948, **127** (9), 124.—See Abstract No. 412 (1948).

708. Water Flood Increases Production. L. S. McCaslin, Jr. *Oil Gas J.*, 26.2.48, **46** (43), 108.—A five-spot flood pattern with well spacing of 10 acres to like wells has been used. The unit has 22 oil, 15 input, and 3 water supply wells. Statistics of the production are given, increasing from an initial 27 b.d. to the present 550 b.d. Water-system details, operating practices, and well-testing procedure are mentioned. C. G. W.

709. Rapid Water By-pass Test. A. Gibbon. *World Oil*, Feb. 1948, **127** (10), 130.—A description is given of a new technique for rapidly ascertaining the existence or otherwise of flood-water by-passing in sands produced by water injection. Certain causes of by-passing and remedial measures to counteract them are also discussed. R. B. S.

710. Purification of Dehydrator Waste. J. C. Albright. *World Oil*, Dec. 1947, **127** (8), 170.—A description is given of a plant suitable for purifying dehydrator water waste and for extracting small traces of oil from it. R. B. S.

Oilfield Development.

711. Oil in the U.S.A. Anon. *Petroleum*, Jan. 1948, **11**, 12.—Production plans in the U.S.A. for the last quarter of 1947 called for a daily average of 5,800,000 brl, or 9% above the 1946 output.

The programme for the last half of 1947 called for the drilling of 18,000 wells. More than 3000 of these were to be wildcats, making the total for 1947 up to nearly 5500 exploration wells.

Means of reducing production costs by redesign of oilfield equipment, improved rig operation, and new techniques are discussed.

Since mud control is now considered an essential for oil production, progress has been made in mud practice, chemical additives, use of oil-base muds, and improvements in rotary hydraulic systems.

For selectively excluding water from sand strata as the oil becomes "watered-out" under the effect of flooding operations, dispersions of solids in water were most promising. Now "Dresinol," an emulsion of a resin-like product, is being used as a plugging agent.

Crude-oil price increases are discussed. F. W. H. M.

712. Gulf of Mexico Discovery. K. B. Barnes and L. S. McCaslin, Jr. *Oil Gas J.*, 18.3.48, **46** (46), 96.—The drilling and development programme of a lease 10 miles off the Louisiana coast is described. Three sands were logged between 1510 and

1786 ft with a total pay thickness of 178 ft. The first exploratory test produced 900 b.d. The lease has indications of being a major pool as reservoir characteristics are extremely favourable. C. G. W.

713. Secondary Recovery in the Rocky Mountains. N. A. Slagter. *World Oil*, Oct. 1947, **127** (6), 170.—Secondary-recovery methods employed in eastern U.S.A. fields are reviewed. R. B. S.

714. [Polish] Drilling and Production in November 1947. H. Gózka. *Statystyka Naftowa Polski*, Nov. 1947, **3** [*Supplement to Nafta*, Jan. 1948, **4**], 19.—Figures are given for crude pumped, gas produced, unrefined gasoline obtained, and drilling operations in progress during November 1947. A graph shows crude and natural-gas production for 1947 together with their origin. Data for December give gas only. Some particularly outstanding figures are given also. The monthly figures are: Crude—10,964,763 kg, natural gas—15,541,000 cu.m., gasoline fraction—625,013 kg, drilling—4399 m. in 74 wells. The article is followed by six comprehensive tables. M. S.

Transport and Storage.

715. Automatic Control on the Portland–Montreal Pipe Line. *C. D. Batchelder and R. A. Rockwell. *World Oil*, Dec. 1947, **127** (8), 195.—See Abstract No. 90 (1948).

716. Heavy Crude and Fuel Oil Handling. E. L. Adams. *World Oil*, Nov. 1947, **127** (7), 226.—Cold weather may cause reductions in the throughput of heavy-oil lines and in severe cases may cause freezing sufficient to form a complete blockage. Methods of overcoming this problem are discussed. R. B. S.

717. Control of Commingling in Products Pipelines. E. A. Birge. *World Oil*, Nov. 1947, **127** (7), 219; *Pipe Line News*, March 1948, **20** (3), 10.—In designing a products pipeline, certain factors have to be considered if minimum commingling is to be obtained: (*a*) selecting a size of pipe such that turbulent flow is maintained; (*b*) planning single-tube system; (*c*) designing for closed-line operation with one station pumping directly into suction of the downstream station; (*d*) streamlining of lines through pumps, scraper tanks, etc.; (*e*) provision of adequate sump facilities. These factors are discussed.

Charts are presented for estimating commingling of gasoline–gasoline and gasoline–kerosine batches, and showing the spread of a number of batches of different products in a typical pipeline system. Commingling in these cases is determined by the gravity of the batches. In the case of kerosine, small quantities of gasoline will affect the flash point and it is considered good practice to provide a kerosine with a flash point 10° above the minimum.

Conclusions arrived at are: (1) commingling depends to a certain extent on differential density and viscosity; (2) as long as turbulent flow is maintained Reynolds No. and velocity have little effect; (3) it is advisable to establish a definite procedure for flushing to station piping; (4) within limits topography has little effect on commingling; (5) effect of pressure is negligible.

An example of the application of commingling data to the design of a new line is given. C. G. W.

718. Products Pipeline Techniques. Anon. *Oil Gas J.*, 26.2.48, **46** (43), 121.—Recent advances in technique and equipment by the Great Lakes Pipeline Co. are described. Engineering details, design of buildings, and handling of products are dealt with. C. G. W.

719. Friction in Pipe Coils or Bends. W. L. Nelson. *Oil Gas J.*, 1.4.48, **46** (48), 281.—A figure shows approximate factors for determination of friction loss in pipe coils as compared with straight pipe; and a table shows similar information for 45°, 90°, and 180° pipe bends except that the extra friction loss is expressed as pipe diameters.

An example is provided and worked out. G. A. C.

720. Metallurgical Properties of High Yield Strength Seamless Line Pipe. A. B. Wilder and J. D. Tyson. *World Oil*, Dec. 1947, **127** (8), 209.—The metallurgical properties of materials used in present-day practice for the manufacture of line pipe are reviewed; applicable welding techniques in general use are also discussed. Recent improvements in corrosion-protection practices have enabled manufacturers to produce line pipe specifically manufactured to meet service conditions without the need for providing excess metal to offset corrosion losses. R. B. S.

721. Threaded Joints. W. R. Nelson. *Oil Gas J.*, 18.3.48, **46** (46), 135.—No. 188 in the *Refiner's Notebook* series lists four chief causes for difficulties with poor pipe threads or faulty pipe joints. The pulling up of joints too tightly is one cause, and a table shows the pull required to make a satisfactorily tight joint. Another table shows correction of pipe-thread faults (hand threading). G. A. C.

722. Electrical Equipment for Oil Pipe Line Pumping Stations. W. G. Taylor. *World Oil*, Oct. 1947; **127** (6), 199.—The factors affecting the installation and operation of the electrical equipment of pumping stations are discussed and certain recommendations are made regarding pumping-station layout. R. B. S.

723. Stuffingboxless Pumps for Operation Without Attendance. P. Reed. *Oil Gas J.*, 5.2.48, **46** (40), 64.—The Dickenson, Texas, station has four automatic stuffingboxless pumps installed underground. The distinctive feature of these units is the immersion of the electric motor in a motor or dielectric oil. Some of the dielectric oil fills the inside of a neoprene bellows in the head of the pump unit. The bellows is surrounded by the pumped liquid at 20 p.s.i. greater than pump suction. In the event of leakage of dielectric oil, the neoprene bellows rises, replacing the lost oil. In the case of excessive loss the bellows actuates an iron pin attracting an Alnico magnet. This opens a switch, darkening an amber warning light. If the magnet rises farther the motor is stopped and a red light turned off.

Advantages claimed are: (1) only attention needed is observation of warning lights; (2) loss of liquid to atmosphere is entirely prevented; (3) units are entirely sealed and may be operated submerged by floodwater; (4) may be installed underground and made fireproof and weatherproof with no buildings or housing.

C. G. W.

724. Gauging Methods in Atmospheric and Low Pressure Storage. C. C. Keane. *World Oil*, Jan. 1948, **127** (9), 170.—See Abstract No. 426 (1948).

725. Tanker Transportation and Inland Waterway Operations. M. G. Gamble. *World Oil*, Dec. 1947, **127** (8), 205. (*Paper presented before A.P.I. Chicago*, Nov. 1947.)—The present status of tanker and inland-waterway operations is summarized. R. B. S.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

726. Modern Refining Processes—1948—Featuring Forty-four Processes. Anon. *Oil Gas J.*, 1.4.48, **46** (48), 117.—Forty-four leading refining processes are presented in a special section with flow charts and discussions of operating principles.

Grading processes include fluid, thermofor, cycloversion, Houdry, suspensoid, and thermal; alkylation include sulphuric acid and H.F.; reforming include perco catalytic and thermal.

Butane and liquid-phase isomerization; catalytic and phosphate disulphurization; copper, mercapsol, and lead-sulphate sweetening, phenol and fufural treating; propane dewaxing and other solvent processes are dealt with.

Hydrocarbon synthesis and electric desalting conclude the list. G. A. C.

727. Clear Lake Plant Designed for Propane-Gasoline Products. C. C. Proyer. *Refiner*, 1948, **27** (1), 87.—The new $2,250,000 gasoline plant which was recently put

into operation by Humble Oil and Refining Co. at Clear Lake, is processing daily 50 million cu. ft of gas-well gas and 31 million cu. ft of casinghead gas formerly burned as waste. Due to the low concentration of product components in the gas well and the casinghead gas the plant is designed to have a high absorption efficiency with a complete removal of ethane from the final products stream. Certain features of the construction of the plant and the steps taken in the process are described and a flow sheet is given. J. T.

728. British Refineries. Manchester Oil Refinery (1). Anon. *Petroleum*, Feb. 1948, **11**, 29.—Describes plant and materials produced at Manchester Oil Refinery. Numerous photographs are presented. The section on the development of new products from petroleum is of interest. F. W. H. M.

729. New Pilot Plant Fractionates Crude in One Operation. Anon. *Refiner*, 1948, **27** (1), 129.—The new pilot plant of Universal Products Co. at their Riverside Laboratories is described. It operates at a crude oil rate of 1 brl/hr, is equipped with automatic control instruments, and is capable of producing a variety of special feed stocks. It consists of three sections, each of which may be operated separately if desired. The sections are: (1) gas-fired crude pipe still with fractionating column and two side-cut strippers in which ordinary fractionation at atmospheric pressure is carried out; (2) electrically heated vacuum furnace and vacuum flash tower with a three-stage steam jet vacuum pump and barometric condensers; (3) two superfractionators arranged for series operation. Some information concerning the operation of the plant is given. J. T.

730. Processing West Texas Crude. W. K. Jackson. *Oil Gas J.*, 1.4.48, **46** (48), 170.—Corrosion experiences processing sour West Texas crude in the 15,000 brl Cosden refinery are discussed.

Corrosion chiefly occurs in furnace tubes, transfer lines, and gasoline condensers; and is combated by desalting, lime injection, and use of corrosion-resistant metal. Desalting has little effect on corrosion suppression in heater tubes or gasoline-condensate equipment; lime injection has been most beneficient on heater-tube life.

In the topping unit it was found that admiralty and cast iron resisted corrosion in condensate equipment, when using lime injection, but on revamping this unit a desalter was added and lime injected at the rate of ¼ lb/brl crude just after desalter.

Corrosion is reduced in clay-treating unit by treating feedstock by Girbotol process.

The conventional cracking unit has suffered little from corrosion except in main fractionator column which has now had lower part relined with 11–13% chrome plate.

Corrosion in crude storage tanks has been severe, and is now being combated by guniting. G. A. C.

731. Fat-Oil De-Ethanization. A. M. Whistler. *Refiner*, 1946, **25**, 645.—Operating cost of a fat-oil de-ethanizer is higher than the usual method of ethane removal. For practical purposes this extra cost is fuel cost. The fat-oil de-ethanizer does not fit certain cases. Where the primary purpose is recovery of propane or propylene a special plant is required. It also does not fit the case where a side stream of propane is sufficient in quantity and quality to supply the market. Operating cost and to some extent first costs make it unattractive. Where oil rates are set by butane recovery and a good market for propane exists, then the fat-oil de-ethanizer has excellent possibilities. G. R. N.

732. Maximum Recovery of Liquefied Petroleum Gases. J. A. Craig. *Refiner*, 1948, **27** (1), 108. (*Paper presented before the first Panhandle Regional Meeting of the Natural Gasoline Association of America*, Texas, Dec. 1947.)—Some gasoline plants built during the past several years were designed for 75–95% of the available propane and 100% extraction of the heavier components present in the gas processed. Such plants, however, have complicated design and their operation costs much more than some of the earlier plants of comparative size. Their design is believed not to be applicable to the existing or earlier plants. The operation of the existing plants are discussed and methods are suggested for increasing the recovery of liquefied petroleum gases.

The problem is treated in two parts—absorption and retention of the absorbed products. The paper is followed by a discussion. J. T.

733. Two-Phase, Two-Component Flow in the Viscous Region. R. C. Martinelli, J. A. Putnam, and R. W. Lockhart. *Trans. Amer. Inst. Chem. Engrs*, 1946, **42**, 681–705.—An analysis is presented of two-phase, two-component (liquid and gas) flow in a tube with phases flowing viscously. A pressure drop equation is developed and the analysis is verified by experimental data for the flow of oil and air in a capillary tube which facilitates the prediction of two-phase, two-component, viscous–viscous, pressure drop for other flow systems. The two-component frictional pressure drop is not appreciably affected by the angle of the tube with the horizontal.

Data here presented and available data for two-phase, two-component flow in porous media are shown to be comparable, and data for the capillary tube is proved to be a special case of flow through a porous medium with very high permeability. J. G. H.

734. Non-Fouling Refinery Charge Stocks. L. F. Schimansky. *Refiner*, 1946, **25**, 629.—The fouling of heat exchangers operating in light clean distillates is discussed with reference to the charging of Californian naphthas and gas oils to thermal and catalytic cracking units. Stocks having a high potential gum test gave the most severe fouling, and it was also found that the oxygen content of the stock was an important factor. Methods are described for the determination of dissolved oxygen and potential gum on the cracking stocks. Removal of oxygen from the stocks on a commercial scale was obtained by a stripping operation using natural gas. G. R. N.

735. Refinery Gas Fuels. L. A. Mekler and C. G. von Fredersdorff. *Refiner*, 1947, **26**, 81.—A comprehensive account of the use of gaseous refinery fuels dealing with the composition of typical gases, gross calorific values, combustion characteristics, velocity of flame propagation, flame luminosity, inspirating burners, rotor-fan premixing burners, flameless burners, and fuel systems. Many burner diagrams and graphs are given. G. R. N.

736. Fractionator Pressure Control. D. M. Boyd, Jr. *Refiner*, 1947, **26**, 113.—Outlines are given of pressure-control systems for atmospheric distillation, vacuum distillation, and pressure distillation. The last type is subdivided into four cases: (*a*) large amounts of inert product; (*b*) small amounts of inert product where the overhead is desired as liquid; (*c*) mixed inert product and vapour where the overhead is desired as liquid; and (*d*) mixed inert product and vapour where the overhead is desired as a vapour. G. R. N.

737. Flue Gas Recirculation. W. H. Roward and E. Durham. *Refiner*, 1947, **26**, 99.—It is shown that flue-gas recirculation is well suited for separately fired superheaters and air heaters. It is applicable also to special process equipment such as benzene superheaters in the plastics industry and for oil heaters in the petroleum-refining industry. In the chemical industry the temperature of chemical bearing gases may be controlled by recirculation in the cooling down process. In the power field where space conditions prevent the use of sufficient radiant heat-absorbing surface to cool the gases below the fusion point of the ash, flue-gas recirculation may be used to cool gases and prevent slagging trouble. Finally it may play an important part in certain types of gas-turbine applications. G. R. N.

738. Rigid Knee-Braced Bents. W. H. Blank. *Refiner*, 1946, **25**, 621.—An analysis of the problems arising in the erection of steel knee-braced single- or double-bay framework. A plan of attacking the problems is set out, and standardization of dimensions with adopted nomenclature and basic criteria which permits any problem to be analysed by the same set of charts and formulæ. G. R. N.

739. Flange Design Considerations. H. E. Lonngren. *Refiner*, 1948, **27** (1), 69.—A graphical method is described illustrating the distribution of stress in a flange

which has been reinforced by the addition of material to provide for loss of metal through corrosion and erosion. J. T.

740. Heat Exchangers as Money Makers. A. M. Whistler. *Refiner*, 1948, **27**, (1), 86.—The best heat exchanger is the one which will make the most money. Economics of heat-recovery operations and the proper way of selecting heat-recovery equipment is discussed. Charts are used to illustrate the relationship between the major variables such as savings and operating conditions. J. T

741. Tower Diameter and Tray Spacing in Fractionation. W. L. Bolles. *Refiner*, 1946, **25**, 613.—Alignment charts are presented for estimating the tower diameter and tray spacing of bubble-plate fractionators. These charts, developed from previously published design procedures, are based on four standard types of tray designs, crossflow with low, medium, and high risers, and the two-pass type. The design procedure outlined is intended to ensure that vapour capacity is sufficient to avoid excessive entrainment, that liquid capacity is sufficient to avoid flooding, and that the design should require a minimum in investment outlay. Example calculations are included to illustrate application of the method, included is a cost study of a typical fractionation case, showing the effect of variation in tower diameter and tray spacing upon tower cost. G. R. N.

742. Cooling Tower Maintenance. J. G. De Flon. *Oil Gas J.*, 1.4.48, **46** (48), 192.—Water treatment, its distributing system and mechanical equipment are dealt with in this maintenance survey.

With regard to water treatment, chlorine is one of the most suitable agents for control of algæ; and rate of scale deposition in piping can be controlled by adjustment of pH value of the cooling-tower water.

The distributing system—of which there are four main types, namely, the upspray, the downspray, the flume, and the pan type—must be kept in good repair to ensure efficient cooling. Algæ growth contributes most to reduced performance, and a complete shut down followed by thorough cleansing with a chemical solution is necessary.

The mechanical equipment must be regularly inspected and a maintenance programme carried out.

Minimum maintenance schedules for atmospheric and mechanical draft towers are given. G. A. C.

743. Field Heat Treating of Refinery Piping. W. H. Fortney. *Refiner*, 1946, **25**, 632.—This article deals with some of the problems encountered in "on the job" heat treatment of welds in the refinery area where furnaces are both unavailable and their use impractical under the subdivisions: grain-structure change, materials commonly encountered, heating rate, thermocouples, burners, and protection of work. G. R. N.

744. Passivation of Aluminium. A. Baeyens. *Ingenieur*, 19.3.48, Mk. 32–34.—Aluminium is the most reactive of metals used in plant construction, but this activity can be totally suppressed by one of four methods: (*a*) anodic oxidation in sulphuric acid or other electrolytes; (*b*) passivation in sodium chromate solution; (*c*) lacquering *e.g.*, with gelatine and sodium bichromate; (*d*) covering with other metals, *e.g.*, nickel chrome.

Sixteen literature references are appended. N. C.

745. Anti-corrosion Aluminium Alloys. A. Jager. *Ingenieur*, 19.3.48, Mk. 30–32.—The composition, properties, and bonding methods for nine aluminium alloys are described. N. C.

746. Corrosion Symposium: Anti-corrosion Steels. A. J. Zuitboff. *Ingenieur*, 19.3.48, Mk. 27–28.—The anti-corrosion properties of the following are briefly described: (*a*) 12–14% chromium steel; (*b*) 16–30% chromium steel; (*c*) 18/8 chromium nickel steel; (*d*) 18/8 steel containing Mo, W, Cu, etc.; (*e*) chromium–manganese steel; (*f*) 20/15, 30/10, etc., chromium–nickel steels. N. C.

747. Utilization of Disposal Plant Effluent in Refining Cooling Water System. G. W. Alexander. *Refiner*, 1948, **27** (1), 92.—In 1943 the Texas refinery of Cosden Petroleum Corpn's water supply, which was drawn from a number of small wells, was not adequate to meet the demand. The water was very hard and required excessive chemical treatments. Extremely hard deposits of sulphate type were encountered and these could not be removed chemically and had to be chipped or scraped off.

In 1944, the city of Big Spring installed a disposal plant for processing the city sewerage. The effluent from this plant was purchased and pumped to the refinery to be used as water supply. A hot-process water softener was installed to treat the effluent. Due to presence of soap in the effluent there was no need for adding soda ash, and a contact with a lime slurry was the only treatment received by the effluent. Due to absence of scaling, long runs and large savings all round were realized. The little scale that was formed in tubular equipment could be removed by a 500 p.s.i. water jet or an 18% hydrochloric-acid solution. J. T.

748. Patent. W. W. Triggs (Gilbert & Barker Manufacturing Co.). B.P. 599,408. 24.3.48. Oil burners. G. R. N.

Distillation.

749. Simple Multicomponent Fractionation Calculations. Part I—Minimum Reflux Ratio. R. V. Bailey and J. Coates. *Refiner*, 1948, **27** (1), 98.—Several methods for the calculation of minimum reflux ratio and the number of trays required in multicomponent fractionation are given. These have advantages over other methods, which have been previously published, in that the time taken up by calculation is less and the accuracy is somewhat greater in many instances.

A modification of the empirical equation of Schiebel and Montross for minimum reflux is suggested, with temperatures properly defined in cases where the relative volatilities are not constant. The modification of Schiebel-Montross formula requires a certain amount of trial and error, but changes the accuracy of the method from an error of 15% to 1%. It is shown that the method is as reliable as correlation of Colburn, but requires less calculation especially as the number of components in the system becomes large. J. T.

Absorption and Adsorption.

750. Modern Process Methods to Improve L.P.G. Recovery. G. W. McCullough, K. H. Hackmuth, and A. J. Miller. *Oil Gas J.*, 25.3.48, **46** (47), 116.—A review of factors influencing absorber performance is given. These include absorber pressure and temperature, lean-oil mol. wt., absorber trays, and lean-oil rate.

Regarding pressure, there is an optimum above which it is not economical to exceed; as for temperature, there are important advantages in lowering absorption temperature. For example, the heavier constituents are selectively absorbed over the lighter gases, thus avoiding absorption of ethane, methane, hydrogen sulphide, and inert gases in the rich oil.

To maintain optimum mol. wt. in order to balance absorption and stripping coefficients, an efficient oil reclaimer is vital in modern plants. Increasing the number of absorber trays results in increased extraction of desirable constituents.

Circulation of lean-oil rate should be reduced if economical high propane extraction is required. Multiple-absorption methods require provision of ample fully stripped lean oil for absorption of pentanes, and a larger volume of partially stripped oil for absorption of propane-butanes. A flow sheet illustrates the principle.

For the economical separation and recovery of propane-butanes in the light gases, bubble-plate separation instead of single flashing should be used. This includes rich oil de-ethanization, two-stage rich oil stripping at high and low pressure, rich-oil desorption, and lean-oil presaturation.

Major factors governing the selection of the process flow for new or revised plant include inlet-gas-volume pressure and composition, residue-gas requirements, and equipment available.

Four figures illustrate the article, and a table compares straight and multiple-absorption systems processing 140 million cu. ft of inlet gas per day. G. A. C.

751. Gas Conservation, High Recovery Provided by Magnolia Petroleum's Vanderbilt Plant. G. Weber. *Oil Gas J.*, 25.3.48, **46** (47), 122. The new gasoline plant at Vanderbilt, Texas, processes both casinghead and high pressure gas. It is designed for a daily throughput of 60 million cu. ft of high-pressure gas and 27·5 million cu. ft of casinghead gas through separate absorption systems.

Residue gas is piped 196 miles for utilization as fuel in the company's Beaumont refinery. Production has averaged daily, 1250 gal of kerosine, 24,200 gal of 14-lb R.v.p. natural gasoline, and 8300 gal of L.P.G. G. A. C.

Cracking.

752. Cracking and Thermal Reforming Pennsylvania Stocks. D. Read. *Oil Gas J.*, 4.3.48, **46** (44), 72.—A summary of certain data available on the processing of Pennsylvania crude, with particular reference to the methods of increasing yield and octane rating of the gasoline and yields of distillate fuels, is presented.

It is shown that it is possible to increase the overall gasoline yield by about 5% and its leaded motor method octane rating by 4·1 points when catalytic cracking is substituted for thermal reforming and cracking. Further, the overall liquid recovery is slightly increased, and 110 b.d. of light distillate fuel is produced at the expense of No. 6 fuel production.

Tables show charge stock and products properties when Pennsylvania gas oil is processed by two-coil thermal cracking and by fluid catalytic cracking methods. G. A. C.

753. Recent Advances in High-Octane Fuel Production. A. G. Arend. *Petroleum*, Jan. 1948, **11**, 7.—Descriptions of "Fluid" catalytic cracking, "Thermofor" cracking and hydrogen fluoride alkylation processes. F. W. H. M.

754. Less than 10 Days Needed for Aurora's New Fluid Catalytic Cracker Turnaround. A. L. Foster. *Oil Gas J.*, 18.3.48, **46** (46), 101.—The turnaround period after 176 days operation on Illinois and Michigan crudes processing 677,400 brl oil required only 10 days and 4,500 man-hours.

Amount of metal loss in reactor was negligible, although some erosion of the perforated plate grid in bottom of the vessel had started. The slide values showed practically no evidence of erosion. With exception of one small area, the monolithic lining in regenerator was in good condition, as were all grids and the Buell cyclones.

Minor changes were made in catalyst stripper, and the inner carbon-steel cylinder in start-up air heater was replaced with unlined stainless steel. The bundle in waste-heat boiler was retubed; and only negligible erosion found in centrifugal slurry pump.

A flow diagram shows the location of the various pieces of equipment, which are discussed. G. A. C.

755. Patents. Houdry Process Corp. B.P. 598,650, 10.3.48. Catalysis.

Phillips Petroleum Co. B.P. 599,495, 24.3.48. Reactivation of catalysts.

C. Arnold (Standard Oil Development Co.). B.P. 599,558, 1.4.48. Process for the catalytic reforming of naphthas. G. R. N.

Hydrogenation.

756. Hydrogenation in the Fuel and Chemical Industries. (Melchett Lecture, 1947.) K. Gordon. *Petroleum*, Nov.–Dec. 1947, **10**, 244.—This is the first part of a paper dealing with the manufacture of hydrogen and of mixtures with nitrogen for making synthetic ammonia, and with carbon monoxide for making synthetic methanol and other products.

Raw materials for hydrogen manufacture are coal, coke-oven gas, and natural gas; electrolysis can be employed where very cheap water power is available.

The well-known method for producing water-gas from coal has an overall efficiency of 55%. Variations in the coke–water-gas process which produce either hydrogen

and nitrogen for ammonia synthesis or hydrogen and carbon monoxide for many organic reactions are described. The problem of introducing heat into water-gas is discussed.

In practice the recovery of hydrogen from coke-oven gas has generally involved liquefaction of part of the gas and its fractionation.

The methane–steam process, developed for natural gases and hydrogenation by-product gases would probably be more attractive, but adequate sulphur removal presents a difficulty to be overcome. This process is discussed, and conditions for producing pure hydrogen and synthesis gas for the Fischer–Tropsch process or methanol synthesis are given. Besides methane, higher saturated hydrocarbons can be used; the thermal efficiency of the process is high.

Subsequent stages of hydrogen manufacture are described with particular reference to desulphurization and catalytic conversion of the carbon monoxide. For synthesis gas a small degree of conversion will suffice, and in this process sulphur compounds are reduced to H_2S, which is easily separable in the later stages. German work on the reaction under pressure is described.

Carbon-dioxide removal is usually carried out by water scrubbing, but separation by ethanolamine has also been employed. Methods for carbon-monoxide removal are given; for ammonia synthesis and some hydrogenation reactions a very low concentration is necessary.

Catalytic processes for the synthesis of ammonia, methanol, and the higher alcohols are described. The latter process was developed in Germany to produce *iso*octane. The *iso*butanol prepared was dehydrated to *iso*butene which was polymerized and hydrogenated. Costs were excessive.

Problems regarding heat removal in the Fischer–Tropsch process might be solved by the adoption of the fluid-catalyst technique as used in the cracking process. The substitution of iron for cobalt as a catalyst in this synthesis produces more alcohols and less hydrocarbons.

Other reactions involving carbon monoxide and hydrogen are given. Of interest is the reaction between hydrogen, carbon monoxide, and olefins discovered by Roelen. The general reaction is:

$$R.CH{:}CH_2 + CO + H_2 \longrightarrow R{\cdot}CH(CHO)CH_3$$
$$\searrow$$
$$R{\cdot}CH_2{\cdot}CH_2{\cdot}CHO$$

A Fischer-type cobalt catalyst is used at 150° C and 200 atm pressure. A mixture of two possible isomers is generally formed. The reaction is not restricted to olefins; it appears that any unsaturated compound, *e.g.*, oleic esters, will react.

Reppe extended this technique using generally the metallic carbonyl in stoichiometric proportions and employing a hydrogen donor instead of hydrogen. As examples:

$$R{\cdot}OH + C_2H_2 + CO \longrightarrow CH_2 = CH{\cdot}COOR$$

and

$$H_2O + C_2H_4 + CO \longrightarrow CH_2{\cdot}CH_2{\cdot}COOH$$

This process can be used to yield esters, acids, amides, and acid anhydrides.

F. W. H. M.

757. Hydrogenation in the Fuel and Chemical Industries. (2) (Melchett Lecture, 1947.) K. Gordon. *Petroleum*, Jan. 1948, **11**, 16.—Hydrogenation reactions are discussed with special reference to the preparation of *iso*octane from the polymerization of *iso*butene. The partial hydrogenation of acetylene to ethylene, as used by the Germans during the war, is mentioned.

Dehydrogenation reactions are described. The advantages of the use of excess steam in the dehydrogenation of butylene to butadiene are given. Also discussed are the hydrogenation of aromatics and the dehydrogenation of naphthenes, which including mention of the hydroforming process. F. W. H. M.

758. Hydrogenation in the Fuel and Chemical Industries. (3) (Melchett Lecture, 1947.) K. Gordon. *Petroleum*, Feb. 1948, **11**, 35.—Phenols can be hydrogenated to either hexanols, aromatics, or naphthenes by suitable selection of catalysts and

conditions. The splitting hydrogenation of cresol to phenol is of interest but is not yet used commercially. There has been practical development in the reduction of nitrobenzene with hydrogen to yield aniline.

The development of sulphide catalysts, such as tungsten sulphide, enables sulphur-containing materials to be hydrogenated without preliminary desulphurization. Their maximum activity depends on a definite partial pressure of H_2S, and this can often be furnished by the sulphur compounds in the feedstock.

In coal and tar hydrogenation, the first or liquid-phase stages are primarily designed to produce products with an end point of 325° C. This temperature is chosen because, with a practical gas–liquid ratio in the vapour-phase stage, it corresponds to the heaviest oil which is completely vaporized. In this process a good deal of oxygen, nitrogen, and sulphur is eliminated and low-boiling hydrocarbons formed, but the product is highly phenolic and contains bases and sulphur compounds.

The next hydrogenation stage, over tungsten sulphide catalyst, gives a substantially pure hydrocarbon oil with elimination of oxygen and nitrogen.

The last stage is a splitting of the type :—

$$R{\cdot}CH_2CH_2R' + H_2 \longrightarrow R{\cdot}CH_3 + R'{\cdot}CH_3$$

The catalysts are selected to produce molecular fission at the desired point. They retain their high activity only in the almost complete absence of nitrogen compounds.

The process is compared with the cracking of petroleum products from the point of view of petrol production. A diagram showing the stages in the production of 100 O.N. aviation fuel from coal hydrogenation is given.

Advances in catalyst development and application are described. Hydrogenation catalysts under reaction conditions are strongly isomerizing—a desirable feature for petrol production.

Hydrocarbon analysis of products produced from creosote oil for aviation petrol is tabulated. The various types occurring in the C_4 to C_7 fractions are given and discussed. A feature is the almost complete absence of higher straight-chain paraffins.

The manufacture of *iso*octane is described by polymerization of *iso*butene and hydrogenation of the dimer and by the alkylation process.

Alkylation of aromatics is mentioned with reference to the formation of cumene and *iso*butyl benzene (" Victane "). The high boiling points of alkylated aromatics restrict their use.

A discussion on the general properties of aviation fuel follows, with some details of engine requirements and octane-rating tests. F. W. H. M.

Polymerization.

759. Patents. Shell Development Co. B.P. 598,914, 10.3.48. Process for the production of polymers of methylpentadiene.

J. C. Arnold (Standard Oil Development Co.). B.P. 598,925, 10.3.48. Low temperature polymerization of hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,378, 24.3.48. Polymerization process.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,437, 24.3.48. High mol. wt. polymeric materials.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,442, 24.3.48. Manufacture of hydrocarbon copolymers.

Standard Oil Development Co. and C. Arnold. B.P. 599,484, 24.3.48. Manufacture of high mol. wt. hydrocarbon polymers.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,803, 1.4.48. Manufacture of copolymers of aliphatic hydrocarbons. G. R. N.

Alkylation.

760. Alkylation and Related Processes of Modern Petroleum Practise. F. C. Whitmore. *Chem. Eng. News*, 1948, **26**, 668–674.—Reactions giving rise to carbonium ions with their unstable electron sextets and the inter- and intra-molecular electron

interchanges, acceptance, and migration, respectively, by which a stable octet is attained, are discussed and illustrated. These changes are then used for the interpretation of olefine and paraffin isomerization, olefin dimerization, and alkylation reactions. E. S. E.

Isomerization.

761. Patents. Texaco Development Corpn. B.P. 598,949, 17.3.48. Catalytic isomerization of saturated aliphatic hydrocarbons.

J. C. Arnold (Standard Oil Development Co.). B.P. 598,952, 17.3.48. Catalytic isomerization of paraffins.

Standard Oil Development Co. and J. C. Arnold. B.P. 599,150, 17.3.48. Catalytic isomerization of paraffin hydrocarbons. G. R. N.

Chemical and Physical Refining.

762. Developments in Technique in Fuels and Lubricants. J. A. Oriel. *I.P. Review*, 1948, **2**, 40.—A survey of the improvements achieved in quality of fuels and lubricants during the last 100 years illustrates the great advances which have been made in refining technique.

Solvent extraction of feed-stock yields lubricating oil of increased value even from crudes which could not be used previously; cracking has made possible the production of high-octane gasoline. The most recent problem of the petroleum industry is the production of fuels for gas turbines; for this purpose alterations in refining processes are likely to be required. O. M.

763. Properties of Solvent Refined Products. V. A. Kalichevsky. *Refiner*, 1947, **26**, 93.—The selectivity, solvent power, and refining power of single solvents are defined on a mathematical basis. Examples are given of their application to commercial results of extraction with liquid SO_2, phenol, chlorex, and furfural. G. R. N.

764. Patents. C. Arnold (Standard Oil Development Co.). B.P. 598,603, 3.3.48. Process for the separation and concentration of olefins.

F. J. Sowa. B.P. 599,214, 17.3.48. Process for separating liquid hydrocarbons from waxes.

Standard Oil Development Co. and J. C. Arnold. B.P. 599,336, 24.3.48. Separation and purification of diolefins.

Shell Development Co. B.P. 599,827, 1.4.48. Solvent extraction for the separation of electrolytes. G. R. N.

Special Processes.

765. Hypersorption Process for Separation of Light Gases. C. Berg. *Trans. Amer. Inst. Chem. Engrs*, 1946, **42**, 665–680.—Hypersorption, a light hydrocarbon recovery process, employs a moving bed of activated carbon to adsorb hydrocarbons out of lean gas streams that cannot be handled economically by other processes. Applications include the recovery of ethylene from gases produced in thermal and catalytic cracking operations, the recovery of propane and heavier components from natural gas, and the separation of methane from hydrogen. The essential feature of the process is the contacting of the feed-gas stream with a moving bed of activated carbon which has been previously stripped and cooled to the desired temperature, followed by separation of the components in the contacting bed by controlled selective adsorption of the heavier constituents, these being subsequently stripped from the carbon at an elevated temperature by steam.

The stripped carbon is returned to the top of the unit, dehydrated and cooled, when the complete cycle is repeated. The characteristics of activated carbon as an adsorption medium are discussed, and constructional and operational details of hypersorption units are presented. J. G. H.

766. Synthetic Alcohol from Petroleum. R. S. Aries. *Oil Gas J.*, 18.3.48, **46** (46), 108.—Ethylene obtained from cracking processes can be hydrated to form ethanol,

but direct hydration is limited thermodynamically to low conversions. Indirect hydration is achieved by treating the ethylene with sulphuric acid to give ethyl sulphuric acid and diethyl sulphate, reacting these with water to produce ethyl alcohol and sulphuric acid, with ethyl ether as a by-product.

After scrubbing with caustic soda, the alcohol is rectified to obtain a very pure product.

Chemical engineering and design data are given for methods of synthetic ethanol production, a flow sheet of the process is given and its economics indicated.

Manufacturing costs of production of synthetic ethanol from ethylene in America are less than 10 cents per gal, to which the cost of ethylene should be added.

G. A. C.

Metering and Control.

767. Modern Refinery Instruments—Installation and Maintenance. G. A. Larsen. *Refiner*, 1948, **27** (1), 103.—(*Paper presented before the Second National Instrumentation Conference in Chicago*, Sept. 1947.)—Principal factors concerning the installation and maintenance of oil-refinery instruments are described. Standardization of instrument installations help in training of the personnel and results in savings in time and material. Worth-while practices and operating methods concerning items such as flow meters, instrument mountings, control valves, and training of personnel are discussed. J. T.

768. The Rotameter. K. Fischer. *Refiner*, 1947, **26**, 106.—The use of the rotameter for measurement of flow rate in the petroleum industry is discussed and deals with the valve body " Rotaline " meter, the bead-guide tube, opaque fluid measurement, continuous viscometers, automatic " inherent " density compensation, explosion-proof transmitting systems, electronically operated rotameters, large capacity roto-sleeves, and " bubbler " service rotameters. G. R. N.

769. Pressure Drop–Coil-in-Box Condensers. W. L. Nelson. *Oil Gas J.*, 11.3.48, **46** (45), 115.—No. 187 in the Refiner's Notebook series shows approximate pressure drops for 100 ft of pipe coil length plus the entry losses through the vapour header, p.s.i. Pounds per hour of product, reflux, and steam or gas, through each branch of coil, range from 400 to 60,000.

Figures are given for gas oil at 540° F and 5 p.s.i.g., regular and light gasolines at 4 p.s.i.g., and pressure distillate at 440° F and 56 p.s.i.g.

The tabulation is based on the fact that the pressure drop is one-third to one-half as great as it would be if no condensation took place. W. M. H.

770. Patent. A. C. Hoffman. B.P. 599,531, 24.3.48. Instruments for controlling the modified viscosity of liquids. G. R. N.

Safety Precautions.

771. Extinction of Petrol Fires by Methyl Iodide. O. C. de C. Ellis. *Nature*, 1948, **161** (4089), 402.—The disadvantages of carbon tetrachloride as a fire-fighting agent are outlined. The effect on petrol fires of carbon tetrachloride, a saturated water solution of ammonium iodide, methylene di-iodide, and methyl iodide are described, and it is claimed that, in addition to yielding non-corrosive end products, the latter is as effective as five times the quantity of carbon tetrachloride. Inflammable liquids other than petrol are extinguished by methyl iodide, and flash-point determinations also illustrate its superiority. H. C. E.

772. Safety is no Accident at Ashland Oil and Refinery Company's Plant. F. J. Sluze. *Refiner*, 1948, **27** (1), 95.—A review of the programme for prevention of accidents at No. 1 Refinery of Ashland Oil and Refining Co. is given. J. T.

PRODUCTS.

Chemistry and Physics.

773. Catalytic Hydrogen Exchange Reactions of Hydrocarbons. J. Aman, L. Farkas, and A. Farkas. *J. Amer. Chem. Soc.*, 1948, **70**, 727.—The following exchange reactions of hydrogen atoms on palladium and nickel catalysts at pressures of 20–700 mm and in the temperature range of 80–170° C were investigated: water and ethylene, water and butene, water and butane, butene and ethylene, and butane and ethylene. It was found that exchange of hydrogen atoms between ethylene and water, butene and water, and butene and ethylene does occur whilst under the same experimental conditions no exchange between butane and water or butane and ethylene was observed. The importance of the mutual displacement of the reactants on the catalyst surface is emphasized. Two possible mechanisms for the exchange reactions are discussed. G. R. N.

774. Rapid Calculation of the Specific Dispersion of Saturated Hydrocarbons. S. G. Hindin. *Refiner*, 1948, **27** (1), 91.—The specific dispersion may be used to determine whether an acid-treated sample of gasoline is substantially aromatic and olefin-free. The dispersion can be directly calculated when a refractometer designed for monochromatic light is used. In the case of Abbé-type refractometers using white light the dispersion is a function of refractive index and drum reading and its computation is tedious. For a rapid calculation of specific dispersion with such instruments a chart is proposed where refractive indices and drum readings are tabulated. From these two values one may determine on the chart the density required to give a specific dispersion equal to that of an aromatic and olefin-free sample. This value of density is then compared with the actual density of the sample. A low value of the actual density then indicates that unsaturates are present. J. T.

775. Light Hydrocarbons and Water. A. P. Houpeurt. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 560–564.—A review is given of the available data regarding the solubility of light hydrocarbons (with particular reference to natural gas) in water and brine. Charts illustrate the variation of solubility with pressure and temperature. The conditions favouring the formation of the hydrates of methane, ethane, propane, and butane are discussed. V. B.

776. Polymerization of *iso*Butylene. I. Action of Phosphoric Acid. II. Action of Acid Iron Phosphates. R. R. Galle and B. N. Parfanovich. *J. Appl. Chem.* (*U.S.S.R.*), 1946, **19**, 1107–1114, 1251–1258; *Rev. Inst. Franç. Pétrole*, 1947, **2**, 567.—The study of polymerization was carried out with a catalyst composed of activated charcoal saturated with phosphoric acid. This charcoal is heated to 120° C and centrifuged, the catalyst containing 76·3% of H_3PO_4 and 23·7% of carbon. Tests were carried out at 50° C, and it was found that the activity of such a catalyst was five to six times > that of the liquid acid. With a contact layer 600 mm thick the yield of di*iso*butylene is 45%, whilst with thin layers (4–5 mm) the dimer yield is 53%. A reduction of the contact time decreases the yield of higher polymers but not of the trimer.

Further tests were carried out with acid phosphates. It was found that $Fe(H_2PO_4)_2$ on charcoal increased the di*iso*butylene yield by 10% as compared to the action of the acid, but this phosphate is unstable and hydrolyses. A mixture of this phosphate with phosphoric acid is more stable; a dimer yield of 80% is obtained at 50–60° C, a higher temperature favouring formation of the trimer. Humidity of the *iso*butylene considerably increases the reaction velocity but decreases the dimer yield and causes rapid exhaustion of the catalyst. V. B.

777. Polymerization of *iso*Butylene and of *iso*Amylenes in the Presence of the Boron Fluoride–Ether Complex. A. V. Topchiev and B. M. Tumerman. *Neft. Khoz.*, 1946, (11), 45–50; *Rev. Inst. Franç. Pétrole*, 1947, **2**, 567.—One of the characteristic properties of boron fluoride (BF_3) is that of forming complexes with oxygen- and nitrogen-containing compounds. Such complexes are frequently catalysts for condensation and isomerization reactions. A study has been made of the polymerization of olefins

from cracking gases in the presence of the complex $BF_3(C_2H_5)_2O$. This material is prepared by treating a mixture of CaF_2 and boric anhydride (obtained by dehydration of boric acid at 700–800° C) with H_2SO_4 at a temperature of 230–240° C. Maximum evolution of BF_3 occurs at about 200° C. The BF_3 is absorbed in anhydrous ethyl ether at 0° C. The excess ether is removed and the complex $BF_3(C_2H_5)_2O$, a fuming colourless liquid, is obtained by distilling at 124° C. The experiments on the polymerization of *iso*butylene in the liquid phase were carried out by filling liquid *iso*butylene into a tube cooled in solid CO_2 and adding 1–10% of the complex. The sealed tube is kept at room temp. for 24 hr, and the BF_3 is then removed by washing with alkali and water. Polymerization occurs with a yield of 90–95%, the product obtained being distilled at 78–220° C; there is obtained about 26% of dimer distilling at 110–115° and 65% of trimer distilling at 168–180° C. The amount of catalyst has little effect on the reaction and 1–2% is sufficient. For polymerization in the gas phase *iso*butylene is passed through a tower containing activated charcoal moistened with $BF_3(C_2H_5)_2O$; the yield of dimer (*iso*-octene) is 19–20%, the optimum temp. being 5° C. The polymerization of *iso*amylenes in the liquid phase occurs at room temp.; on adding the complex to an *iso*amylene mixture boiling at 21–35° C the reaction starts immediately. The amount of catalyst required is 2% and the polymerization yield is 80%. On distilling a yield of 80–85% dimer boiling at 148–156° C is obtained. The gas-phase polymerization of *iso*amylenes occurs at ordinary pressure in a similar manner. The O.N.'s of the polymers are in the range 85–92.

V. B.

778. "Low Temperature" Oxidation of Higher Hydrocarbons at Atmospheric Pressure. G. Friedlander and L. Grunberg. *Nature*, 1948, **161** (4088), 360.—In experiments on the ignition of *n*-heptane and 1 : 1 (vol) *n*-heptane–benzene mixtures between 300 and 500° C it was found that a "pre-ignition pulse" occurred. Measurements of the time interval between the start of the reaction and the pulse (t_1) and that between the pulse and ignition (t_2) showed that t_1 decreased, and t_2 passed through first a minimum and then a maximum, with increasing temperature. Analyses of the gases collected before ignition occurred showed that a maximum in peroxide content was followed by a maximum in aldehyde content, and that the pre-ignition pulse coincided with a decline in the peroxide concentration.

It is concluded that initiation of the reaction occurs through the formation of *sec.*-alkyl radicals leading to the formation of peroxides, the decomposition of which to aldehydes gives rise to the pulse. The hypothesis that decomposition of *sec.*-alkyl hydrogen peroxides is responsible for the branching reaction (ignition) is not supported by experiment, for with *n*-heptane at 316° C a pressure pulse not followed by ignition was obtained. Also the addition of T.E.L. to *n*-heptane did not suppress the pressure pulses, but prevented ignition which would otherwise have occurred.

H. C. E.

779. Gaps in Physical Constants Data for Hydrocarbons. N. Corbin, M. Alexander, and G. Egloff. *J. Coll. Phys. Chem.*, 1948, **52**, 387–394.—The importance of correlations between the physical properties and the structures of hydrocarbons is stressed, and the quality and quantity of data needed for such correlations is discussed. The analysis of the available data shows the percentage of known alkanes, unsaturated aliphatics, alicyclics, mononuclear aromatics, and polynuclear aromatics for which each of four physical constants (melting point, boiling point, density, and viscosity) has been recorded. Further analysis shows the percentage of compounds in each class for which the data was adequate to calculate a "best value." A comparison of correlations covering the different classes of hydrocarbons shows that the quality and quantity of the data are reflected in correlations. Suggestions are made for further research on physical constants.

D. F. J.

780. Investigations Concerning Polymerization of Propane and Ethane Induced by Tetraethyl Lead. P. L. Kooijman and W. L. Ghijsen. *Rec. Trav. Chim. Pays-Bas.*, 1947, **66**, 247–256; *Rev. Inst. Franç. Pétrole*, 1947, **2**, 568.—Propylene and ethylene undergo polymerization under the influence of T.E.L. in the neighbourhood of 300° C and at pressures > 250 atm. The polymerization induced is calculated by carrying

out the same tests without the catalyst and deducting the thermal polymerization thus caused. It has been found that with an initial pressure of 250 atm. the maximum induced polymerization for propylene is at 300° C when 480 mols polymerize per mol of T.E.L.; in the case of ethylene the maximum is at 276° C with a polymerization of 1850 mols. Such initiator yields increase with a rise in initial pressure. The nature and composition of the products formed appears to be independent of the initiator's presence and are only dependent on the temperature and pressure. In the case of ethylene oily products have been obtained (as residues from distillation carried out at 200° C/15 mm); their mol. wt. is 580–900, which decreases with an increase in reaction temperature. The product obtained at 310–330° C had a V.I. of 117. V. B.

781. Reaction of Methyl*cyclo*pentane with Propene. A. Pines and V. N. Ipatieff. *J. Amer. Chem. Soc.*, 1948, **70**, 531.—The reaction of methyl*cyclo*pentane with propene in the presence of aluminium bromide–hydrogen bromide was carried out at − 42° C. The product obtained from the reaction consisted of alkylated *cyclo*hexanes composed mainly of 1-methyl-2-ethyl*cyclo*hexane and of alkyl*cyclo*hexanes of the formula $C_{13}H_{24}$. Under the reaction conditions methyl*cyclo*pentane underwent but slight isomerization. A mechanism of the alkylation is suggested. G. R. N.

782. Oleophobic Monolayers II: Temperature Effects and Energy of Adsorption. W. C. Bigelow, E. Glass, and W. A. Zisman. *J. Coll. Sci.*, 1947, **2** (6), 563–591.—Investigations of the effect of temperature on the oleophobic properties of polar compounds dissolved in cetane and di*cyclo*hexyl show that above a critical temperature T a platinum foil is permanently wetted by the solution; *i.e.*, the oleophobic properties of the solution disappear. It was found that: (1) for a number of derivatives of higher *n*-paraffins, T increases to a constant value as the concentration w is increased, and the initial value of dT/dw is greater the more adsorbable the compound on platinum; (2) for derivatives of *n*-octadecane, T falls in the order amide > amine > acid > alcohol; (3) the longer the chain length of the compound, the higher is the value of T.

These results are explained by the desorption of the polar molecules due to increased thermal agitation of the hydrocarbon chains and vibration of the polar groups on the surface. Theoretical treatment of the system leads to the equation $C = A \exp(-U/RT)$, where T is the temperature at which a solution of concentration C is not oleophobic, U is the energy required to move a mol of adsorbed film, and A is a constant. This equation was found to be substantially correct experimentally. The value of U is independent of the solvent and decreases with the number of C atoms in the adsorbed molecule, and it is considered that U represents the adsorption energy of the unassociated molecule. The constant temperature value (T_{max}) at high concentrations is attributed either to micelle formation at T_{max}, or to equilibrium between increased probability of adsorption and the increased rate of desorption caused by solubility effects.

For a given derivative of *n*-paraffin, the temperature τ at which the film from the molten substance ceases to be oleophobic increases linearly with number of C atoms (N). If it be assumed that τ corresponds to the temperature at which thermal agitation is so great that oriented films are impossible, theoretical treatment also leads to a linear relation between τ and N.

Calculations support the view that U is largely cohesion energy due to van der Waals forces between adjacent CH_2 groups, and that the adhesional energy between polar groups and platinum is due to electrical interaction. In discussing these results, the correlation between T_{max} and the chemical activity of adsorbed compounds is pointed out. In the use of these compounds as anti-wear agents in lubricating oils they must be assumed to react with the metals to be lubricated, and the more unreactive the bearing metal the lower is its load-carrying capacity in association with an oil containing an anti-wear agent. The similarity of values of U derived from the changes of T and the stick-slip transition temperature T_s with concentration shows that T and T_s are co-related, although they are not necessarily identical. Some differences between T and T_s are illustrated by a molecular model; thus it is essential to have closer packing in an adsorbed monolayer to prevent stick-slip than to prevent wetting, and hence $T_s < T$. Branched-chain molecules have lower

values of U than corresponding straight-chain molecules and will therefore be less adsorptive; and their use as anti-wear agents will be more limited.
(See also Abstract No. 899 (1947).) H. C. E.

783. Studies in the Terpene Series VIII. H. Pines, R. C. Olberg, and V. N. Ipatieff. *J. Amer. Chem. Soc.*, 1948, **70**, 533.—Pinane on dehydrogenation yields in addition to the previously reported *p*- and *o*-cymene also a large amount of 1 : 2 : 4- and 1 : 2 : 3-trimethylbenzene, the ratio of products obtained depending upon the temperature, solvent, and catalyst support employed. The cleavage of the four-membered ring of pinane appears to occur by two different reactions; a thermal cleavage to favour the formation of *p*-cymene and a hydrogenolysis which favours the formation of 1 : 1 : 2 : 3- and 1 : 1 : 2 : 5-tetramethyl*cyclo*hexane and *o*-menthane. The hydrogen liberated from the former reaction causes the latter reaction to occur. At high temperatures the tetramethyl*cyclo*hexanes undergo demethanation and dehydrogenation to the corresponding trimethylbenzenes. The dehydrogenation of pinane is inhibited when it is diluted with four mol of pentenes. Pentane and benzene enhance the extent of dehydrogenation of pinane. A comparative study of the dehydrogenation of *p*-menthane using the same variables was made. G. R. N.

784. Application of Thermodynamics to Hydrocarbon Processing. Part VII. Hydrocarbon Properties for Derivations. W. C. Edmister. *Refiner*, 1948, **27** (1), 74.—Application of thermodynamics to petroleum processing is generally discussed and items such as average boiling point, U.O.P. characterization factor, viscosity gravity constant, and diesel index are described. A table of physical constants of some thirty hydrocarbons is given and P.V.T. relations in single and multicomponent systems are briefly discussed. J. T.

785. Vapour Pressure–Temperature Relationships among the Branched Paraffin Hydrocarbons. H. Wiener. *J. Coll. Phys. Chem.*, 1948, **52**, 425–440.—The boiling points (b.p.) of the branched-chain alkanes at pressures from 57 to 780 mm are expressed by equations of the form $\Delta t = \frac{k}{n^3}\Delta\omega + b\Delta p$, the coefficients k and b being given by simple logarithmic functions of the pressure. ω is the sum of the distances, in terms of *C–C* bonds, between the members of all pairs of C atoms in the molecule, p is the number of pairs of C atoms separated by three bonds, and t is the b.p. $\Delta\omega = \omega_n - \omega\text{-}iso$, $\Delta p = p_n - p\text{-}iso$, and $\Delta t = t_n - t\text{-}iso$.

The constants A and R of the Antoine Equation for branched-chain alkanes are related by equations of similar form. When the constant C is evaluated from the normal b.p., the average deviation between observed and calculated b.ps., tested on 466 points at which v.p.–temperature equilibrium of isomeric alkanes is given in the literature, is $\pm$ 0·17° C. D. F. J.

786. Role of Black Cobalt Carbide in the Fischer–Tropsch Synthesis. S. Weller, L. J. E. Hofer, and R. B. Anderson. *J. Amer. Chem. Soc.*, 1948, **70**, 799.—Evidence is presented that for cobalt catalysts, bulk cobalt carbide is neither an intermediate in the Fischer–Tropsch synthesis nor a catalytically active substrate for the synthesis. The presence of extensive amounts of carbide in cobalt catalysts severely inhibits the Fischer–Tropsch synthesis. Used catalysts show no carbide by X-ray analysis, but samples carbided before synthesis show carbide to be present after synthesis.
G. R. N.

787. Affinity and Reaction Rate Close to Equilibrium. I. Prigogne, P. Outer, and A. Herbo. *J. Coll. Phys. Chem.*, 1948, **52**, 321–331. The thermodynamics of irreversible phenomena leads to linear and homogeneous relations between affinities and reaction rates close to equilibrium. These laws have been verified experimentally in the case of the catalytic reaction of the hydrogenation of benzene and the inverse reaction of the dehydrogenation of *cyclo*hexane. The domain of validity of these laws is discussed.
D. F. J.

788. Theory of Burning Velocity. II. The Square Root Law for Burning Velocity. C. Tanford and R. N. Pease. *J. Chem. Phys.*, 1947, **15**, 861–865.—Previous papers

by the authors have suggested that the diffusion of active particles from the flame front is the controlling factor in combustion in Bunsen-type burners. In this paper an equation for burning velocity based on such a concept is derived. The equation shows that the burning velocity should be proportional to the square root of an expression in which the most important factor is the sum of the products $p_i D_i$ for all effective atoms or free radicals, p_i being the concn. of an atom or radical at the flame front, and D_i its coefficient of diffusion into cold unburned gas. The equation is applied to the combustion of CO and H_2, and excellent agreement between calculated and experimental values is obtained. The equation is also used to account for the effect of pressure upon burning velocity. D. F. J.

789. Absolute Reaction Rate of Unimolecular Decomposition. J. O. Hirschfelder. *J. Chem. Phys.*, 1948, **16**, 22–25.—The assumption made in the usual theory of absolute reaction rates that the molecules in the activated state are in statistical equilibrium with the molecules in the initial state is not justified in the case of unimolecular decomposition because the energy of activation must be gained by a stepwise process. The size of the energy jumps and their frequency will affect the overall reaction rate. By considering the problem for a rough idealized mode it is found that the actual reaction rate should be smaller by a factor of 0·5–0·387 than the value computed from the usual theory of absolute reaction rates. D. F. J.

790. Maximum Possible Rate of Evaporation of Liquids. S. S. Penner. *J. Phys. Coll. Chem.*, 1948, **52**, 367–373.—An equation is obtained for the maximum possible rate of isothermal vaporization of liquids. It is shown that the resulting relation for the decrease of droplet radius with time gives results of the same order of magnitude as the relation obtained from the kinetic theory of gases. Assumption of the validity of the new treatment permits an independent determination of the free volume of a liquid. D. F. J.

791. Influence of Water Vapour on Flame Temperatures in Carbon Monoxide Explosions. A. Smeeton Leah. *Phil. Mag.*, 1947, **38**, 657.—Expressions for deriving both mean and instantaneous flame temperatures have been developed which enable results from a 3-in. dia. spherical explosion vessel to be interpreted. Photographic records of pressure rise, as shown by an optical diaphragm indicator, and flame travel are taken simultaneously.

Flame temperatures obtained by this method are plotted against flame diameter for both wet and dry mixtures of 37% carbon monoxide and 63% air. Ideal temperatures for the same mixture are given as a comparison. It is shown that there is a large amount of chemical energy unaccounted for during combustion, particularly with the dry mixtures. This defect in energy in each case reduces with increase of flame travel.

The conclusion drawn from this work is that the missing energy is due to David's "latent energy" and to abnormal dissociation. Water vapour acts as a catalyst in the carbon-monoxide–oxygen reactions by providing new chain carriers of the type OH and H, which increase the reaction velocity. The increase in efficiency of combustion when water vapour is present is due to the formation of a smaller proportion of abnormally excited CO_2 molecules. H. A. C.

792. Infra-Red Emission Spectra of CO_2 and H_2O Molecules. E. K. Plyer. *Science*, 1948, **107**, 48.—Two emission bands at 14 and 15 μ for CO_2 and a number of emission lines for water have been detected in the spectrum of a Bunsen flame using either manufactured or natural gas. A curve representing the infra-red emission of CO_2 in the regions of 13·9 and 15·0 μ is given. J. T.

793. Experimental Determination of the Intensities of Infra-Red Absorption Bands. III. Carbon Dioxide, Methane, and Ethane. A. M. Thorndike. *J. Chem. Phys.*, 1947, **15**, 868–874.—The absolute intensities of the chief infra-red absorption bands of CO_2, CH_4, and C_2H_6 determined experimentally, are in satisfactory agreement with the available data on infra-red dispersion and atomic polarization. The results may be interpreted in terms of dipole moments of bonds between vibrating atoms, and their rates of change with internuclear distance. When this is done for the CH

bond, however, unexpected variations in these quantities are found for the different vibrations and molecules studied. D. F. J.

794. Heat Capacities of Liquids and Vapours. S. W. Benson. *J. Chem. Phys.*, 1947, **15**, 866–867.—By the use of an equation previously derived, an expression is derived relating $\left(\frac{\partial \Delta E}{\partial T}\right)_{sat}$, where ΔE is the energy of vaporization and T the temperature, to the difference in molar heat capacities at constant pressure of the liquid and vapour (ΔCp). Values of ΔCp calculated from an approximation of the equation are in good agreement with experimental values. D. F. J.

795. On the Thermodynamics of Non-Electrolyte Solutions and its Technical Applications. III. Systems with Associated Components. O. Redlich and A. T. Kister. *J. Chem. Phys.*, 1947, **15**, 849–855.—The influence of continuous association of one component on the free energy of a non-electrolyte solution is derived from a few assumptions. The result is in accord with available data for hydrocarbon–alcohol solutions. Systems of two associating components and the general interpretation of the free energy of non-electrolyte solutions are briefly discussed. D. F. J.

796. Note on the Relation between Entropy and Enthalpy of Solution. O. K. Rice. *J. Chem. Phys.*, 1947, **15**, 875–879.—The relation between entropy and enthalpy of solution for a series of non-polar solutes in a given non-polar solvent is discussed. Two extreme cases, between which real solutions will usually stand, are considered; (1) the case of an ideal solution, and (2) the case of a solution in which solute molecules consist of hard spheres which occupy space but do not exert attractive forces on the solvent molecules. D. F. J.

797. Effect of Temperature and Pressure on Specific Gravity. P. M. Reynolds. *Oil Gas J.*, 11.3.48, **46** (45), 96.—It has been shown that compressibility and thermal-expansion properties of a number of liquids may be expressed by the equation $\rho - \frac{\rho_1}{\omega_1}\omega$, where ρ = density at desired temperature and pressure, and ω = expansion factor at the same conditions. The term $\frac{\rho_1}{\omega_1}$ is constant for any given material. A graph is given which relates the expansion factor to reduced temperature and reduced pressure, and from this curve, a known value of density, and critical temperature and pressure data, the density at any desired temperature and pressure can be calculated using the equation above.

A table is included which gives the values of $\frac{\rho_1}{\omega_1}$, for petroleum oils, ranging according to characterization factor from specific gravity 0·65 to 1·08, and examples illustrate the determination of specific gravity of a number of oils at varying temperatures and pressures. Three literature references are included. W. M. H.

798. Statistical Thermodynamics of the Sorption of Vapours by Solids. M. Dole. *J. Chem. Phys.*, 1948, **16**, 25–30.—The statistical method, begun by Fowler and Guggenheim and extended to multilayer sorption by Cassie and Hill, is further generalized to include variable heats of sorption in different layers. It is shown under what conditions multilayer sorption can lead to a linear isotherm and to various modifications of the BET equation. The treatment is also extended to the case of interaction between sorbed molecules in the same layer. D. F. J.

799. Use of Tritium in the Determination of the Solubility of Water in Solvents. The Solubility of Water in Benzene. G. G. Joris and H. S. Taylor. *J. Chem. Phys.*, 1948, **16**, 45–51.—The method was devised to enable small amounts of solvent to be used, thus permitting the study of solvents available in the pure state only in small quantities. The solvent is saturated with radio-active water, a sample (*ca.* 1 cc) of the solution taken and its radioactivity measured with the aid of a Geiger–Müller counter. The results obtained are compared with values previously determined by other workers. D. F. J.

Analysis and Testing.

800. Evaluation of Crude Oil. A. G. Adams. *Refiner*, 1947, **26**, 126.—A description of a simple laboratory still for the recovery of straight-run aviation gasoline from crude oil. G. R. N.

801. Estimation of Hydrogen Content of Gas Oils. C. Allen. *Refiner*, 1947, **26**, 116.—A nomograph is presented which relates hydrogen content with A.P.I. gravity, refractive index, and mol. wt. of gas oils. The derivation of the nomograph is given. G. R. N.

802. Oil Filtration and Its Effect on Engine Wear. Anon. *Petroleum*, Nov.-Dec. 1947, **10**, 263.—Investigations on the effect on engine wear of rates of filtration of lubricating oils, carried out by C. C. Penfold and D. S. Gray of the Armour Research Foundation, were presented at a recent S.A.E. National Fuels and Lubricants Meeting.

Engine-wear characteristics were evaluated when the oil was partial-flow, full-flow, and when no filter was used. A four-cylinder Caterpillar diesel engine was employed. The wear rates were evaluated from the weight loss of the piston rings, ring-gap increase, and dimensional change. The drained oil and oil from the filters were analysed for increase in iron content.

The average of the total weight loss for all piston rings of the particular flow-test series was 448 mg for partial-flow, 369 mg for full-flow, and 618 mg without a filter.

As measured by cylinder-wear rate, the removal of the oil filter decreased engine life by about 38%; changing from partial to full-flow prolonged engine life by about 18%.

The full-flow filter was the more effective for the removal of iron. Analyses of the used oils showed that about six times as much iron was found as compared with the partial-flow filtration and about half as much as the partial-flow.

The results of particle-size distribution for oils from a partial-flow test are tabulated. The average particle size was less than one micron; only an occasional agglomerate occurred.

About half the iron was metallic, the rest being in solution or very finely divided (passing No. 42 filter paper). The former had obviously been removed from the upper cylinder region, thus showing the results of analyses of the oils to be comparable with the piston-ring wear figures.

Results of electron microscope studies have led to the belief that the metallic iron particles are carried in aggregates of graphitic carbon. Suggestions for further studies are given. F. W. H. M.

803. Water Content of Propane. F. H. Poettmann and M. R. Dean. *Refiner*, 1946, **25**, 635.—A study was made of the propane–water system for the condition where two liquid phases and a vapour phase co-existed. The compositions of the propane-rich liquid phase and the vapour phase are reported for the temperature range 60–187° F. Equilibrium vaporization constant curves for water and weathering diagrams are presented for both the propane–water and *n*-butane–water systems. In the analytical procedure the water was quantitatively removed from the propane by use of anhydrous magnesium perchlorate. G. R. N.

804. Patent. J. C. Arnold (Standard Oil Development Co.). B.P. 599,550, 1.4.48. Spectrographic apparatus. G. R. N.

Crude Oil.

805. Composition and Properties of Petroleum in West Virginia. A. J. W. Headlee, R. E. McClelland, and H. A. Hoskings. *Producers' Monthly*, Oct. 1947, **11** (12), 33.—This paper is the second report regarding the determination of the composition and properties of West Virginia petroleum (for first report see Abstract No. 119 (1948)). In this part further extensive data are presented in tabular form of the fractional distillation analysis and aromatic content of West Virginia petroleum samples. Data are also given of the sulphur content, specific gravity, refractive index, refractivity intercept, and surface and interfacial tensions of the various aromatic extracts. R. B. S.

Engine Fuels.

806. Significance of Fuel Sensitivity in the Performance of Motor Gasoline. E. J. McLaughlin and J. A. Miller. *Refiner*, 1948, **27** (1), 112.—Fuel sensitivity is the change in the antiknock value of a fuel as a function of the severity of operating conditions used. If the octane number of the fuel is too low, then each vehicle will have an optimum sensitivity which will give a uniform degree of freedom from knocking or constant knock intensity under most full-throttle operating conditions. If a fuel having a sensitivity very much different from that required by an engine is used, under certain combinations of load and speed knocking will result. Under certain conditions this may also cause an excessive antiknock margin if the engine is adjusted for knock-free operation on the fuel of wrong sensitivity. Lowering the octane requirement of the car by retarding a spark by more than several degrees from the manufacturers' setting will result in loss of power and economy, accelerated deposit build-up, and overheating of the engine. J. T.

807. Effect of Sulphur Compounds on Octane Number of Leaded Fuels. I. Comparison of Different Sulphur Compounds. H. K. Livingston. *Oil Gas J.*, 11.3.48, **46** (45), 80–87.—The presence of sulphur causes a reduction in the octane number of leaded, though not unleaded, motor fuel. Tests have been carried out to determine the effect of a number of pure sulphur compounds, using a 60-*iso*-octane : 40-heptane blend as a base fuel, 3 cc per gal T.E.L, and fuel-rating method D-357-46.

Results show that the greatest decrease in octane number is brought about by the following types of compound: alkyl tetrasulphides; thiols; primary alkyl disulphides; alkyl sulphides; sulphur; thiophenes. Increasing the chain length of sulphur compounds in a homologous series does not alter the effect on octane number. At equal sulphur concentrations all thiols have approximately the same effect on octane number, while sulphides containing aromatic rings have less effect than completely aliphatic sulphides.

The antagonism of sulphur compounds towards T.E.L. bears a log–log relationship to the sulphur concentration, over a broad range of sulphur concentrations.

A list of 26 references is included. W. M. H.

808. Patents. Standard Oil Development Co. and J. C. Arnold. B.P. 598,767, 10.3.48. Prevention or inhibition of oxidation in petroleum hydrocarbon products.

J. C. Arnold (Standard Oil Development Co.). B.P. 598,895, 10.3.48. Starting of I.C. engines and fuels therefor.

C. Arnold (Standard Oil Development Co.). B.P. 599,132, 17.3.48. Fuels for C.I. engines.

Anglo-Iranian Oil Co., W. A. Partridge, and H. J. Alty. B.P. 599,222, 17.3.48. Motor fuels.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,733, 1.4.48. Stabilization of hydrocarbon materials. G. R. N.

Lubricants.

809. Progress in the Science and Art of Lubrication in 1947. E. V. Paterson. *Petrol. Times*, 13.3.48, **52** (1320), 259.—Emphasis is laid on the importance of co-operation between engineer and oil chemist. Important additive developments and the problems of compatibility and filtration thereby created, are mentioned. C. G. W.

810. Investigating the Analysis and Control of Lubricants Used by the Dutch Railways. H. L. Matthijssen. *Ingenieur*, 16.4.48, (16), Mk. 37–45.—The specifications for the various grades of lubricants used by the railways are summarized in tables. A description is given of an artificial ageing test by Mollinger in which the oil is stirred for 85 min at 230° C. The results of analysis of various used oils before and after the introduction of a stream line filter are given.

The use of a churning apparatus for greases is illustrated and nine charts plotting penetration against temperature for different periods and temperatures of churning conclude the article. N. C.

811. Chemical Constitution and Aromatic Groups in Petroleum Lubricants. Part I. C. Zerbe and K. Falkens. *Refiner*, 1947, **26**, 131.—Liquid SO_2 extracts of an American spindle oil were studied; individual group constituents were separated by high vacuum-distillation procedures. The mol size of the groups including sulphur derivatives increases with increase in boiling point. The chemical constitution of individual fractions was arrived at by absorption spectrum analyses: aromatic and aliphatic combinations of hydrocarbons were calculated to be present. Good agreement was found between the observed and calculated mol fraction. The absorption spectra results were substantiated further by thermal cracking. Temperature-viscosity curves of fractions of the extracts and raffinates were compared. G. R. N.

812. Preparation of Lubricating Oils from Hydrocarbon-Synthesis Products. (1). G. H. Dazeley and C. C. Hall. *Petroleum*, Jan. 1948, **11**, 14.—This is the first of two papers dealing with a series of investigations to study the production of lubricating oils from olefins derived by cracking the higher fractions of the primary product of the Fischer–Tropsch hydrocarbon synthesis. The fractions concerned were diesel oil and waxes, distilling at 200–300° C and above 300° C, respectively. The selection of suitable cracking conditions and the production and properties of the lubricating oils obtained from the cracking of the diesel-oil fractions are discussed.

Three cracking processes were tried: (*a*) autoclave at 450° C; (*b*) thermal, at 600° C and atmospheric pressure; and (*c*) catalytic, using silica–alumina gel at 600° C.

Spirit from the autoclave process was polymerized to a lubricating oil (residue above 200° C at 3 mm) in poor yield and of low V.I.; catalytically cracked spirit produced insignificant amounts of polymer in the lubricating oil range.

Thermally cracked product of b.p. below 170° C was polymerized at 80° C in the presence of 5% aluminium chloride giving a good yield of oil having a viscosity of 490 cs at 100° F and 34·5 cs at 200° F with a V.I. of 91.

Since only the thermally cracked product provided a suitable polymerization stock, the difference between the spirits produced by the three cracking methods was studied. The conclusion was reached that the difference in behaviour must have been due to a difference in constitution of the reactive hydrocarbons. This was borne out by the densities of the 140–170° C spirits; they were:—

Autoclave cracking—density d_4^{20} 0·7546
Thermal cracking—density d_4^{20} 0·7323
Catalytic cracking—density d_4^{20} 0·7850

Although the thermally cracked product had the highest olefin content, it had the lowest density, thus implying that it had the greatest proportion of straight-chain hydrocarbons.

These observations are in accordance with a Ruhrchemie A/G patent which claims that olefin-containing spirits from cracked hydrocarbon-synthesis products having a density for a narrow cut differing by less than 1% from a specific value (varying with the mean b.p. of the spirit) give good yields of oil of favourable V.I.

An investigation on the polymerization of pure olefins by Koch and Hilberath is discussed and related to the work carried out. Experiments showing that aromatics present are not likely to be incorporated to a significant extent in the lubricating-oil product are cited.

It is concluded that the thermally cracked spirits suitable for lubricating-oil production probably contain mainly α-mono-olefins, principally straight-chain. Other cracking conditions produce other types of olefins including cyclic types, to which structures the unsuitability of these products are referred.

While the high densities of the unsuitable polymerization stocks may be due to aromatics, their presence does not appear to be the reason for the unsuitability.

F. W. H. M.

813. Lubricating Oil Additives. A. S. Ham. *I.P. Review*, 1948, **2**, 22.—Additives to improve viscosity index, anti-ring sticking, anti-corrosive, detergent, and other properties of lubricating oils were necessitated by the development of engines to operate under greatly increased severity of service conditions. From the economic point of view a balance had to be struck between incorporation of large percentages of additive to normally refined oils and smaller percentages to more highly refined oil

though in arriving at a correct conclusion difficulty is encountered due to lack of correlation between engine tests and service behaviour.

Suitable additives must have the following properties apart from their ability to improve oil characteristics: solubility in the specific oil to the required extent, exceptions being anti-foaming dopes, which are effective as dispersions, and pour-point depressants; stability towards water; they must not detract from the appearance of the oil, *i.e.*, darken its colour; their volatility must be low enough to prevent loss by vaporization in service; they must not lose their value when subjected to working temperatures; if two or more additives are incorporated in an oil, as is often the case with high-grade engine lubricants, they must be compatible with each other.

From the above it must be concluded that, although the formulation of additive-containing oils is necessary, it is a difficult task and often compromises must be made if all requirements are to be fulfilled. O. M.

814. Colloidal Graphite as a Substitute for Vegetable Oils in Compounded Lubricants. A. H. Stuart. *Petroleum*, Nov.–Dec. 1947, **10**, 257.—Oil lubricants function under the conditions of the fluid film; high bearing temperatures or pressures will cause the oil film to be squeezed out of the bearing and the metallic surfaces to approach each other until the distance of separation becomes critical.

An oil can only be considered satisfactory if, under these boundary conditions, it is adsorbed by the bearing surfaces with such tenacity that no pressure or temperature likely to be met in practice, will dislodge it. Vegetable oils, or equivalent fatty acids, exhibit this adsorption phenomenon more than mineral oils. Modern lubricants are usually compounded of a very stable mineral oil and a little vegetable oil or fatty acid. Most long-chain compounds with a CH_3 group at one end and a CO_2H group at the other are adsorbed on bearing surfaces, but their lubrication properties, chemical stability under working conditions, and sludge-forming propensities, limit the number available for use.

The disadvantages and short supply of vegetable oils has caused attention to be paid to the dispersion of pure colloidal graphite in lubricating oils. The advantages offered by graphite are: (*a*) it is adsorbed with great tenacity and is unaffected by any temperature rise likely to be met in practice; (*b*) the adsorbed film of graphite is highly oleophilic; (*c*) it is chemically inert; and (*d*) it has a high load-carrying capacity.

It has been shown that the heat of wetting of a metal by an oil is a measure of the adhesion of the oil to the metal, which in turn is a function of the lubricating properties under boundary conditions. Experiments showed that a mineral oil plus 1% oleic acid had a heat of wetting four times that of the oil alone whereas with graphite it was ten times that amount.

Results quoted using a Thoma machine show the relative merits of the graphite film at high pressures, and the temperature effects on a Bowden stick-slip apparatus have been investigated and compared with compounded oils.

Experiments on wick lubrication showed that graphite passed up the wick without clogging the channels; this was confirmed by a felt-filter experiment. Evidence is given that the addition of graphite slightly increases the rate of flow of an oil and also produces a substantial reduction in friction.

The advantages of the use of colloidal graphite in oils for running-in new engines are described. F. W. H. M.

815. Graphite Lubrication. R. H. Savage. *J. Appl. Phys.*, 1948, **19**, 1–10.—It is found that the slipperiness of graphite is not due entirely to crystal structure, but depends upon adsorption films, especially water, which cover the carbon atoms and provide surfaces of low cohesion. Graphite rods held against a rotating disc in vacuum wear away as a fine dust having great adsorptive power. The view is expressed that the wearing process involves a tearing apart of the individual scales at right angles to the slip planes. This wear is stopped by some condensible vapours (*e.g.*, H_2O, C_6H_6, NH_3) at low pressures which apparently effect the coverage of the graphite by a reversible adsorption governed by the pressure and surface temperature. At zero wear the graphite friction may be accounted for as the heat of cohesion of water monolayers attached to the carbon atoms and undergoing successive makes

and breaks. The mechanism of graphite lubrication is compared with and contrasted to that of metallic lubrication. D. F. J.

816. Patents. J. C. Arnold (Standard Oil Development Co.). B.P. 599,337, 24.3.48. Lubricating-grease composition.

Standard Oil Development Co. and J. C. Arnold. B.P. 599,776, 1.4.48. Manufacture of lubricating greases. G. R. N.

Bitumen, Asphalt, and Tar.

817. Asphaltic Bitumen. A. J. Hoiberg. *Refiner*, 1947, **36**, 77.—A concise account of the history and development of asphaltic bitumen dealing with its early sources and applications, present sources, and the nature and manufacture of petroleum asphalts. G. R. N.

818. Effect of Petroleum-like Constituents on Road Tars and a Test for Determining the Homogeneity of Road Tars. R. H. Lewis and W. J. Halstead. *Public Roads*, Mar. 1948, **25** (3), 53.—Road tars meeting the same specifications frequently exhibit differences in behaviour, traced to the presence in the tars of petroleum-like constituents consisting of unsulphonatable hydrocarbons.

These hydrocarbons have a flocculating effect on the tar, and increase in the percentage of unsulphonatable hydrocarbons increases the effect until a separation of the blend into two phases occurs. Microscopic examination is necessary to detect the progressive flocculation up to the point of separation.

A series of blends of tar and diesel oil were made and examined, and it was found that the viscosity of the tar has slight effect on separation point. The amount of unsulphonatable hydrocarbons that can be tolerated by each tar tested is approximately constant.

A new test was devised to measure the relative compatibility of unsulphonatable hydrocarbons and tars. Increments of a petroleum distillate were added to the tar and the "separation point" noted, the percentage of diluent at which the blended materials separate into two phases being recorded.

The method should be useful as a rapid laboratory check on the uniformity of supplies of tar from the same source, as it indicates the relative amount of unsulphonatable hydrocarbons in such tars, but it cannot be used in place of the sulphonation index test for an exact determination of these constituents.

Twelve tables and six figures illustrate the work. G. A. C.

Special Hydrocarbon Products.

819. Wool Piece Goods Scouring with a Synthetic Organic Detergent. O. M. Morgan. *Amer. Dyestuff Rept.*, 1948, **37**, (3), 93–95.—Emulsified mineral-oil lubricants are coming into wider use by the textile industry. Laboratory and other tests are described which indicate the efficiency of a synthetic organic detergent for the removal of such products from wool piece goods. Under normal conditions, some difficult problems are encountered. The type of salt used as a builder for this synthetic detergent, and also the alkalinity, have an important bearing on the scouring efficiency. C. N. T.

820. Liquid Paraffin for Cooking. Anon. *Brit. Med. J.*, 1948, i, 769.—High dosage with liquid paraffin could lead to deposition of this in the liver, but there is no evidence that this would cause pathological consequences. Excessive use of liquid paraffin may, however, cause vitamin A deficiency due to the preferential solubility of provitamin in oil, with consequent loss in the fæces. It is considered that the use of liquid paraffin as a vegetable-oil substitute in food products should be prohibited. V. B.

Derived Chemical Products.

821. Economic Trends in Coal Tar Hydrocarbons. J. M. Weiss. *Chem. Eng. News*, 1948, **26**, 238–240.—Production and consumption of coal-tar hydrocarbons are sur-

veyed. Aromatics, natural and synthetic, from petroleum are playing an increasingly greater part in the supply position. Phthalic anhydride from petroleum *o*-xylene eases the naphthalene shortage. E. S. E.

822. Vulcanization of Synthetic Rubbers by the Peachey Process. M. B. M. Ledahl, F. A. Quinn, and E. W. Zimmerman. *Bur. Stand. J. Res., Wash.*, 1948, **40**, 1.—The Peachey process, which has been used to vulcanize natural rubber by subjecting the rubber alternately to sulphur dioxide and hydrogen sulphide gases, has been applied to synthetic rubbers.

Polymers studied include natural rubber, GR-S (butadiene–styrene), GR-M (polychloroprene), GR-I (*iso*butene–*iso*prene), GR-A (butadiene–acrylonitrile), and Hycar OR-15 (similar to GR-A).

The rubbers were tested in thin strips, being subjected to cycles of exposure to SO_2 for 5 min, air for 10 sec, and H_2S for 5 min. The number of cycles was varied for each rubber to find the optimum cure. The extent of cure of each strip was qualitatively evaluated by hand stretching.

It was found that none of the synthetic rubbers cured any faster than natural rubber: the nitrile and styrene copolymers of butadiene cured at about the same rate or a little slower, GR-I and GR-M took over fifty times as long as natural rubber. H. A. C.

823. Patents. N.V. de Bataafsche Petroleum Mij. and P. A. Winsor. B.P. 598,487, 3.3.48. Purification of oil soluble sodium naphthasulphonates.

N.V. de Bataafsche Petroleum Mij. and S. R. Airs. B.P. 599,545, 24.3.48. Manufacture of dihalides of aliphatic mono-olefins. G. R. N.

Coal, Shale, and Peat.

824. Russia's Oil Shale Industry. S. Klosky. *Chem. Eng. News*, 1948, **26**, 862–864.—Oil-shale deposits are widely distributed. The estimated reserves in 1938 were 26×10^9 tons. Details of retorts for gasification and distillation and analysis of typical shales and shale ashes are given. A modified Pintsch and the Klimov retorts are described. A microfilm of the original papers of which the article is a digest is obtainable from the Bureau of Mines. E. S. E.

Miscellaneous Products.

825. Preparation and Properties of GR-S. F. J. Soday. *Trans. Amer. Inst. Chem. Engrs*, 1946, **42**, 647–664.—GR-S is the butadiene–styrene copolymer selected by the U.S. Rubber Reserve Co. as a general-purpose synthetic rubber suitable for mass production for defence purposes. Details are given of Government GR-S, butadiene, and styrene plants. Methods of design and operation of a typical plant comprising tank farm and pigment preparation, reactor, recovery, coagulation, and finishing plant are described with the aid of a flowsheet. Differences, advantages, and disadvantages of GR-S as compared with natural rubber are outlined, and comparative costs are discussed. J. G. H.

826. Patents. Shell Development Co. B.P. 598,962, 17.3.48. Synthetic resins and their production.

Shell Development Co. B.P. 598,988, 17.3.48. Manufacture of phenol compounds.

Shell Development Co. B.P. 599,145, 17.3.48. Synthetic resin processes.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,252, 24.3.48. Production of aromatic amines.

J. C. Arnold (Standard Oil Development Co.). B.P. 599,729, 1.4.48. Manufacture of the metal derivatives of alkyl phenols and their sulphur, selenide, and telluride derivatives. G. R. N.

Engines and Automotive Equipment.

827. Avro's Mamba-Athena. Anon. *Aeroplane*, 6.3.48, **74**, 354.—An interesting project is the fitting of an Armstrong-Siddeley Mamba gas turbine into a limited number of Athena Mark I air frames by A. V. Roe. Some preliminary details are given. I. G. B.

828. Latest Road-Vehicle Engine. Anon. *Oil Engine & Gas Turbine*, Feb. 1948, **15**, 336.—A new diesel, four-cylinder, goods-vehicle engine, in production by Albion Motors Ltd, Glasgow, has a power output ranging from 39½ b.h.p. at 1000 r.p.m. to 75 b.h.p. at 2000 r.p.m. Maximum torque is 208 ft.lb at 1200 r.p.m., and the b.m.e.p. just under 100 lb/sq. in. A single alloy iron casting forms the crankcase and cylinder block; "dry" liners of corrosion-resisting cast iron are fitted. Other interesting features include obliquely split big-end bearings, allowing the withdrawal of the complete piston and connecting rod assembly upward through the cylinders; two-hole fuel injectors, which are less prone to clogging than the usual four-hole design; and automatically variable timing for the fuel injection. As in standard petrol-engine practice, vacuum generation for the brakes is provided by the pistons, made practicable by an automatic by-pass valve which opens when the engine has dropped to idling speed, and admits sufficient air to keep it running satisfactorily. C. D. B.

829. New 3 to 50 b.h.p. Four-Stroke Units. Anon. *Oil Engine & Gas Turbine*, Feb. 1948, **15**, 358.—A new range of small vertical four-stroke oil engines, with a power range of from 3 to 50 b.h.p., has been announced by Associated British Oil Engines Ltd. These engines, which will be produced by the Petter Engine Division of the Brush Electrical Engineering Co., Loughborough, will be known as the Petter AV-type, with a range of from 3 to 10 b.h.p., and the BV-type, ranging from 17 to 50 b.h.p. The AV-type only is being produced at present, in single-cylinder and twin-cylinder models.

Brief specifications of the engine include a combustion-chamber design giving a high degree of turbulence; a cast-iron cylinder provided with a "wet" type of liner; splash lubrication of the cylinder walls, small-ends, and camshaft; a centrifugal governor mounted on the crankshaft gear wheel, and a power take-off at either crankshaft speed or half speed. A multiple-disc clutch running in oil can be fitted either to the full- or half-speed shaft. As the units are flow produced, interchangeability of parts is ensured, and the engines are suitable for a wide range of duties. C. D. B.

830. Cold Facts. Anon. *Flight*, 25.3.48, **53**, 322.—A short report is given of the Canadian A.R.C. research on icing in the gas turbine, particularly in the turbo-jet types. I. G. B.

831. Gas Turbine Accessory Systems. O. N. Lawrence. *J. Roy. Aero. Soc.*, 1948, **52**, 151–185.—The requirements of a fuel system for gas turbines are stated, and the types of engine and their characteristics are summarized; fuel consumption data under different operating conditions are quoted. Starting systems and problems associated with these are discussed. The subsequent discussion includes *inter alia* contributions, having more specific reference to fuel characteristics. C. N. T.

Miscellaneous.

832. Petroleum Today and Tomorrow. K. F. Mather. *Advancement of Science*, 1948, **4**, 292.—In this lecture to the British Association, Professor Mather emphasized that petroleum is a non-renewable resource. Annual world production has increased each year since 1938 and there is every indication that it will continue to increase. Average annual production is estimated at three thousand million brl during decade 1947–56. This figure is significant when compared to proved world reserves of about seventy thousand million brl. It is erroneous, however, to conclude that world's oil

will be exhausted in twenty-three years, as proved reserves are only a fraction of actual reserves.

Although at present in America proved reserves at the end of each year were greater than at the beginning of the year, by 1950 a maximum will have been reached, and thereafter the increase in reserves will decline to zero. This is further illustrated by a curve of "New Proved Reserves per Exploratory Foot Drilled." This curve is steadily declining.

The U.S.A. possesses about 30% of world reserves, and its production is running at 60% of world production. It is predicted that in ten to twenty years the U.S. will be a "have not" nation as far as petroleum is concerned, the "have" nations being the Soviet Union, Kuwait, Iran, Iraq, Arabia, and the East Indies. Practically all the potential fields of the last five of these countries are under the control of American, British, and Dutch corporations.

At present world consumption is 4% of proved reserves, and about 1% of actual reserves. Demands are certain to increase, mainly owing to increased use of petroleum by nations who have not hitherto been large consumers. Assuming complete freedom for distribution of petroleum regardless of political boundaries it would appear that reserves are adequate to meet demands for half to three-quarters of a century.

The author concludes that it is necessary especially for U.S.A. and Great Britain to seek alternative sources of gasoline, diesel oil, fuel oil, and lubricants, such alternatives being oilshale and coal of which there are reserves for many hundreds of centuries. H. A. C.

833. The Petroleum Industry. G. G. Oberfell. *Chem. Eng. News*, 1948, **26**, 23–25.—A brief survey is made of the expanding petroleum industry in the U.S.A. over its several aspects of exploration, crude production, refining, transportation, and petroleum chemicals. In refinery expansion programmes refining flexibility is the keynote. 700 million gal (approximately 35% of the liquified petroleum gas production for 1947) were used in the chemical industry. Aromatics are being supplied in increasing quantities from petroleum sources. Synthetic detergents are likely to reach 25% of total soap production. The extensive investment in research has contributed largely to improvements in all fields of activity. E. S. E.

834. Survey of Natural-Gasoline Plants. Anon. *Oil Gas J.*, 25.3.48, **46** (47), 135.—A 1948 survey of 513 natural-gasoline and cycling plants in the U.S.A. is presented.

Production capacity of the gasoline plants, totals over 14 million gal/day, and the cycling plants yield some 5 million gal/day, giving a total of nearly 20 million gal/day, inclusive of liquefied petroleum gases. G. A. C.

835. Construction under Way Will Increase Output of Natural-Gasoline Cycling Plants. R. B. Tuttle. *Oil Gas J.*, 25.3.48, **46** (47), 145.—A review of new gasoline and cycling plant planned or under construction is presented, and completion dates quoted.

The expansion will provide for 11–12% increase on present production. In several cases the projects involve mainly the addition of equipment or revamping of existing facilities in the production of L.P.G. G. A. C.

836. North American Operating Refineries, Their Capacities and Location. Anon. *Oil Gas J.*, 1.4.48, **46** (48), 227.—A summary of active plants in the U.S.A., Canada, and Mexico, and of shut-down plants in the U.S. and Mexico, is presented.

Total capacity in the U.S.A. is given as approximately 6 million b.d. of crude oil with 3¼ million cracking capacity, 21,000 and 11,000, respectively, in Canada, and 188,000 and 36,000 b.d. in Mexico. G. A. C.

837. Field Control of Petroleum Products in the European Campaign. E. A. Smith. *Petroleum*, Jan. 1948, **11**, 8.—During the European campaign quality control of all military and aviation petroleum products was maintained in the field.

The system of field control and the organization involved is described. Details of the scope of testing are given and problems arising in the field and their solution are discussed. A full description is given of a mobile laboratory. F. W. H. M.

838. Britain's Oil Refining Programme. G. Tugendhat. *Times Rev. Ind.*, May 1948, 18–19.—Implications of the forthcoming expansion of home-refining in the U.K. are discussed. Based on U.S.A. figures an average modern non-specialized refinery costs $12,000–15,000 per ton/day throughput. As Middle East will be main source of crude for British refineries up to 100,000 tons/yr of sulphur will become available. The difficulties of producing current market requirements for petroleum products from Middle East crude are stressed and it is suggested that international integration of refinery programmes would be desirable. It is considered that the proposed capital expenditure of £95 million, for a throughput of 20 million tons/yr, will have to be exceeded. V. B.

839. Acetylene Production in Germany. R. B. Randall. *I.P. Review*, 1948, **2**, 13.—Shortage of petroleum products in Germany during the war led to their replacement by synthetic materials based on acetylene. To cope with increased demand the calcium carbide process was supplemented by high-temperature pyrolysis of hydrocarbon gases, particularly methane. The only one of these to reach full scale was the " arc process " which involves the subjection of gas, ex hydrogenation plants, to a temperature of about 2000° C in electric arcs using copper electrodes, the by-products including carbon-black and ethylene. The product was concentrated under pressure giving a gas containing 97% acetylene.

Two other processes were evolved but only reached pilot-plant scale. The " partial oxidation process " requires 100% hydrogenation gas and pure oxygen, heat being supplied by combustion of part of the raw material. Preheated gas and oxygen were reached at 1500° C and immediately quenched. The product, containing about 9% acetylene, was concentrated as in the " arc process " to 70% purity. Pre-ignition of the gases caused destruction of the burners. This problem was not solved.

The " thermal cracking process " was based on the finding that diminished pressure in pyrolysis of methane favoured acetylene production, the best yields being obtained at about 1500° C under 76 mm pressure. Difficulties arose from the endothermic nature of the reaction, from undesirable by-products, *e.g.*, diacetylene, carbon, etc., and in purifying final product. Burning of carbon produced solved the first two difficulties to a great extent and water washing under 10 atm pressure isolated the diacetylene. Purification was similar to that in the two previous processes.

O. M.

840. Petroleum [in Poland] in 1947. Z. Wilk. *Nafta*, Jan. 1948, **4**, 1–6.—Describes changes in organization of the Polish petroleum industry from November 1945 to December 1947, and mentions achievements made, and plans for 1948.

Previously relying on help from UNRRA and U.S.S.R., the industry has been developed along scientific lines. Objectives were achieved in all the various branches due to the separation of the synthetic works from Central Office for Liquid Fuel Industry—now the Petroleum Industry.

This enabled the administrative staff to do its duty which previously fell on the shoulders of the technical man. Careful planning brought good results; equipment and transportation bottlenecks were cleared. The aim was set on more production and less drilling, and 7·5 tons per drilled metre was reached. Daily production reached 380 tons of crude per day. Maximum drilling speed of 65 m per day was reached; many new minerals were located.

A total of 174,866·4 tons was refined in 1947. A laboratory was established and it produced a popular burner, a percussion coring bit, and other improvements. Technical education was widely supported and central petroleum workshops were established. A special exploration company carries on search for oil. The industry is now a profit-making one and supplies 30% of the country's requirements. Plans include a solvent-refining plant, natural gas supply to Warsaw, and general development in all directions. M. S.

841. New Mechanical Seal for Oil Process Pumps. Anon. *Petrol. Times*, 13.3.48, **52** (1320), 278.—A new type of mechanical seal for oil-refining process pumps is described. The seal, known as type RR, was developed by Flexibox, Ltd., of Manchester. C. G. W.

842. Radio Communication. G. Weber. *Oil Gas J.*, 4.3.48, **46** (44), 63.—The article reviews the use of radio communication for drilling wells, pipe lining, and field plant. Technical advances are expected to extend the use of radio to all divisions of the petroleum industry. The limiting factor is the competition for available frequencies. Considerable savings are reported from existing installations, one contractor claiming to have saved the initial cost of the network in the first six months of operation.
C. G. W.

843. Pressure Drop in Vapour Lines. W. L. Nelson. *Oil Gas J.*, 4.3.48, **46** (44), 97.—No. 186 in the *Refiner's Notebook* series gives a chart showing approximate pressure drop in 100 (equivalent) ft of vapour line (4 in to 16 in) for lb/hr product reflux, and steam or gas (from 2000 to 700,000 lb/hr). The data given is for gasoline and cracked distillate, and an example is worked out. G. A. C.

844. Occupational Diseases. G. B. Oliver. *J. Soc. Dyers Colourists*, 1948, **64**, 57–60.—The toxicity of various substances, *e.g.*, lead (and particularly tetra-ethyl lead), benzol, and other solvents, is discussed. Other topics of interest to the petroleum industry include dermatitis, industrial lung diseases, and cancers. C. N. T.

845. Patent. J. C. Arnold (Standard Oil Development Co.). B.P. 598,971, 17.3.48. Manufacture of corrosion-resistant conduits. G. R. N.

BOOK REVIEWS.

Statistical Methods in Research and Production. (With special reference to the Chemical Industry.) O. L. Davies. London: Imperial Chemical Industries Ltd. 1947. Pp. 292 + xi. 28*s*.

The foreword by Lord McGowan to this handbook on statistical methods explains that it is the policy of Imperial Chemical Industries Ltd to publicize the company's information accumulated from its manufacturing experience and research. This policy is a laudable one and there is much to be recommended in its first venture. Dr. Davies edits the handbook and the contributors are L. R. Connor, W. R. Cousins, Dr O. L. Davies, Dr F. R. Himsworth, H. Kenney, W. L. Stevens, and Dr C. C. Tanner.

This book is in a form most suitable for specialists in the chemical industry who wish to make use of conventional statistical methods. In content, it lays considerable emphasis on the correct usage of these methods, and for this purpose the necessary mathematical equations are clearly set out and applied to examples drawn from the experience of the writers. Workers in the petroleum industry will find common ground in many of the worked examples. The practising statistician may also benefit from a reading of the book since it gives a picture of the extent to which statistical methods have been applied to the chemical industry.

The first three chapters deal with fundamental concepts and measures of dispersion. These chapters give the necessary background to the techniques and tests introduced in the next three chapters, which include tests of significance, the analysis of variance and regression and correlation. The remaining chapters deal with the chi-squared distribution, sampling, control charts and statistical inference. The book is completed by the inclusion of a glossary of statistical terms, symbols, and tables of statistical functions. Each chapter is concluded by references to more detailed works and the general index, used in conjunction with the contents page, eliminates very largely any tiresome searching. In editing, it is evident that an attempt has been made to preserve the thread of an argument by relegating detail to appendices. To some extent this has worked well, but becomes unwieldy in Chapter 5 where one is confronted with eleven appendices.

The omission of the very important subject of the planning of experiments is explained by the fact that it is proposed to deal with this in a second volume.

A disappointing feature is the scant treatment given to the subject of specification and control testing. The petroleum industry is keenly interested in the question of the efficiency of control testing and in assigning estimates of variability to standard tests. The principles and methods of dealing with the general problem are given elsewhere, but it is considered that insufficient practical advice is given in Chapter 10. If a revision of the book is contemplated, the authors would serve an important cause by amplifying their experience on this subject. I. G. B.

A Correlation of Some Physical Properties of Alkanes and Alkenes. Boiling Points, Molecular Volumes and Surface Tensions. R. C. Huston. East Lansing, Mich.: Michigan State College Press. 1947. Pp. 96. $1.75.

This monograph, which is based on lectures on the relationship of physical properties to chemical constitution, deals mainly with the effects which the configurations and energy contents of alkane and alkene molecules have upon some of the important physical properties of the compounds.

The author makes use of concepts such as intramolecular dispersion, relative energy, co-ordination ability, cohesion, terminal contact, and contact area, the last being a new term introduced into this work. In this way the variations in properties of isomers are considered in relation to the properties of the normal hydrocarbon and the bulk of the monograph consists of graphical plots of this kind and the relevant discussion. Thus for the nine isomeric heptanes the boiling points are plotted against the relative energies at 0° K and the deviations of the points obtained from a line passing through the point for the normal isomer and representing its hypothetical energy—boiling-point curve—are taken as measures of the decreases in boiling point of the other isomers, due to differences in co-ordination. Co-ordination is defined as "the effectiveness of intermolecular

dispersion forces of the isomeric hydrocarbons as compared with those of the normal hydrocarbon of the same relative energy content."

Besides the effect of co-ordination on boiling point, the effects of contact area on molecular volume and of branching on surface tension are also considered for the alkanes from the butanes to octanes and for the alkenes from butenes to hexenes. The work is an interesting attempt to correlate and explain some of the often puzzling variations in the properties of isomeric hydrocarbons. E. B. E.

The Motor Industry of Great Britain, 1947. London: The Society of Motor Manufacturers and Traders Ltd, 148 Piccadilly, W.1. 1947. Pp. 452 + iii. £2 post free.

Whatever one wishes to know in statistics of Britain's motor industry in 1946 and in some instances in the first half of 1947 is to be found in this volume. In all cases comparative figures for 1938 are given, and in some the corresponding data for the years 1932–38 is included. For motor-vehicle production the figures are continuous from 1908 to 1938, and for vehicles in use the table starts at 1904 and is complete to 1946. From this it is of interest to note that in September 1946, the total number of motor vehicles (excluding motor cycles) in use in the U.K. was 2,554,047 and that this total has only been exceeded on two occasions—1938 with 2,644,202 and 1939 with 2,749,852.

There is also much useful information in regard to vehicles in use in other countries of the world. From this has been gleaned the information that at December 1946 the U.S.A. had 33,233,975 cars and commercial vehicles in use, this being equivalent to a population of 4 persons per vehicle. At the other end of the scale is China with 19,500 vehicles or 25,179 persons per vehicle.

The only information on the fuel side is a diagram of U.K. retail petrol prices 1922–47 and a table of comparative world petrol and diesel-fuel prices in 1946. A useful chapter deals with U.K. motor-vehicle legislation.

This publication can be thoroughly recommended to all who have need of statistics of the motor industry. G. S.

Selected Values of Properties of Hydrocarbons. Frederick D. Rossini, Kenneth S. Pitzer, William J. Taylor, Joan P. Ebert, John E. Kilpatrick, Charles W. Beckett, Mary G. Williams, and Helene G. Werner. Washington, D.C.: U.S. Government Printing Office. 1947. Pp. 483 + xiii. $2.75.

In 1941 the U.S. National Bureau of Standards and the American Petroleum Institute agreed a co-operative programme on the compilation of tables of selected values of properties of hydrocarbons and in 1942 the work commenced as A.P.I. Research Project 44.

The aims of the project in regard to the physical and thermodynamic properties of hydrocarbons and related compounds are to examine, appraise, and correlate existing data, to make original calculations as needed, and to prepare, publish, and keep up-to-date tables of selected values.

Since the beginning of the work, tables have been published in loose-leaf form, and the present volume is a complete collection of the 385 tables as at May 31, 1947. The arrangement of the volume is in five main parts: (I) Introductory; (II) Tables of Fundamental Constants, Conversion Factors, Useful Equations, and Molecular Weights; (III) Tables of Selected Values of Properties; (IV) Specific References for Tables of Properties; (V) General List of References.

The main tables in Part III number 358, and occupy 360 pages, the arrangement being a numerical classification of compounds which, combined with a letter index of properties, enables the desired value for a particular hydrocarbon to be readily traced. G. S.

BOOKS RECEIVED.

A.S.T.M. Manual of Engine Test Methods for Rating Fuels. Philadelphia, Pa.: American Society for Testing Materials. 1948. Pp. 320 + xvi. $8. (Obtainable from the offices of the Institute of Petroleum, price £2 2*s*. post free.)

This Manual gives five standard methods of rating fuels (Motor—Research—Aviation—Supercharge—Cetane). Six supplements are included on best practices currently in use for laboratory facilities, installation of test units, reference materials, ancillary services, operation, and maintenance.

A.S.T.M. Proceedings, 1947. Philadelphia, Pa.: American Society for Testing Materials. 1948. Pp. 1197 + ix.

This Volume 47 of the A.S.T.M. Proceedings covers the Fiftieth Annual Meeting at Atlantic City, June 16–20, 1947, and contains among many others the following committee reports :—

D-2 on Petroleum Products and Lubricants.
D-3 on Gaseous Fuels.
D-4 on Road and Paving Materials.
D-8 on Bituminous Waterproofing and Roofing Materials.
D-9 on Electrical Insulating Materials.
D-12 on Soaps and Other Detergents.
D-16 on Industrial Aromatic Hydrocarbons.

The technical papers in the volume include one on "Polargraphic Determination of Tetraethyl Lead in Gasoline," by R. Borup and H. Levin.

German and Japanese Intelligence Reports.

B.I.O.S.

1033. Oilfields Investigations in Italy. Pp. 42.
1712. Medium Pressure Synthesis with Iron Fixed-bed Catalysts, and Operation of the Fischer–Tropsch Synthesis in the Liquid Phase. Interrogation of Dr. H. Kolbel. Pp. 7.
1722. Additional Information Concerning the Fischer–Tropsch Process and its Products. Pp. 184.
Misc. 68. Problems of Dephenolization of Waste Liquors. Pp. 36.
Misc. 71. German Diesel Fuels. Pp. 30.

F.I.A.T.

Tech. Bull. T-40. Processing Bavarian Clay to Activated Clay (Bleaching Clay). Pp. 2.

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Zakharov, B. A., 932
Zhakhovskaya, T. P., 957

Oilfield Exploration and Exploitation.

Geology.

846. Prospective Acreage as a Measure of Discovery Expectancy. J. S. Herold. *Oil Gas J.*, 22.4.48, **46** (51), 80.—No company or individual has a monopoly of the essential knowledge or tools needed for acquiring leases or finding oil. These are available to all, and only in their application do some companies show a greater skill than do others. Although skill is a leading factor in the initial search for and selection of favourable lands, chance is a deciding factor in the actual drilling.

The operations of one company may throw light on the leases of another, and on this account some companies carry greater reserves of acreage than they might do otherwise. The rewards of a discovery are frequently shared. Average future discoveries are likely to be a preponderance of small finds, and the reserves of most companies have grown large on these.

Concentration of acreage in large blocks removes the advantages which might accrue from the activities of others. The general spreading of benefits means that the overall discovery results are roughly proportional to the area of prospective territory held.

Chance enters at the point where prospects of equal apparent merit may prove dry or productive.

The U.S.A. activities of twenty-five companies are analysed and the results are presented in a series of tables. G. D. H.

847. Proven Reserves Show Gain in 1947. C. J. Deegan. *Oil Gas J.*, 11.3.48, **46** (45), 64.—At the beginning of 1948 U.S. crude-oil reserves were estimated to amount to 21,487,685,000 brl, an increase of 614 million brl during 1947. Natural gas liquid reserves were placed at 3254 million brl at the beginning of 1948, and natural-gas reserves at 165,930,000 million cu. ft. The fuel-oil equivalent of the natural-gas reserves is about 33,000 million brl.

Tables give the various types of reserves by States, with the changes during 1947, due to discoveries, extensions, and production. G. D. H.

848. Wildcat Drilling in 1947. F. H. Lahee. *Oil Gas J.*, 8.4.48, **46** (49), 79.—During 1947, 1378 exploratory wells completed in U.S.A. were productive, and 5397 were dry. Their footages were respectively, 6,166,163 ft and 20,227,185 ft. 1301 of the successful wells were located on technical advice, 31 for non-technical reasons. New field wildcats accounted for 200 producers and 1691 dry holes; 101 of the producers were located by geophysical data, and 63 by a combination of geology and geophysics. Among new field wildcats major companies had 134 producers and 647 dry holes. Gross new proved oil reserves in 1947 are estimated to be 2,717,601,000 brl.

Tables summarize the results of drilling in 1947 by States, and compare the footage and results by years from 1938 for the Southern States. The bases for the 1947 locations are analysed in further tables, and statistics on reserves are given. G. D. H.

849. Pennsylvanian Possibilities near Hugoton Field. Anon. *Oil Gas J.*, 11.3.48, **46** (45), 139.—1 Bear, NW NW SE 17–32s–40w, Morton County, Kansas, on the west edge of the Hugoton gas field, has produced 7,000,000 cu. ft/day of gas with a spray of distillate in a drillstem test on a Pennsylvanian sand at 5011–5017 ft. Hugoton is a huge Permian stratigraphic trap with porosity pinching out up-dip on a monocline. Small oil or gas pools have been found to the northwest, west, north, northeast, and east in the Pennsylvanian or Mississippian. The area cannot be considered to have been tested fully. It lies on the northwest edge of the Anadarko Basin. G. D. H.

850. New Pennsylvanian Pool for West Texas. Anon. *Oil Gas J.*, 15.4.48, **46** (50), 129.—In opening and testing a well abandoned in 1941, in Hale County, Texas, oil has been recovered by swabbing. During further operations oil and gas have been recovered from either the Cisco or the Canyon formation. The well is 7½ miles east of the single well in the Petersburg pool, where oil is in the Cisco. G. D. H.

851. Canadian Completion Attempt Draws Wide Attention. Anon. *Oil Gas J.*, 1.4.48, **46** (48), 295.—A well in Pincher Creek, southwest Alberta (LSD 15 24-3-29w 4), has flowed at the rate of 8,000,000–10,000,000 cu. ft of gas and 7–100 b.d. of 54° condensate in short tests. The well is in the Madison in the overthrust belt of the Rockies, and is 11,927 ft deep. G. D. H.

852. Leduc Rapidly Becoming Canada's Greatest Oil Reserve. N. Williams. *Oil Gas J.*, 15.4.48, **46** (50), 99.—The Leduc field embraces 10,000–11,000 acres, and is so far defined only on the east side. Reserves from two overlapping zones are estimated at 80–100 million brl. In February a producer was completed 3¼ miles northwest of the present most northerly producer in the field, and may represent an extension.

The overall time for a completion is now 35–40 days. Initial potentials have ranged from 500–2700 b.d., but outputs are restricted. Production is from the Devonian, below the Lower Cretaceous. Three dolomitic zones are present. The uppermost has irregular porosity, and spotted oil and gas shows; heavy oil has been recovered in drillstem tests. The second zone produces, and has the best porosity and permeability in its middle part. Porosity pinches out eastwards. No gas cap is present and there may be a water drive. The lower zone is believed to be a reef, and has better porosity. Eastern production in this zone is limited by a sharp change in dip.

The oil is 38–40° A.P.I. Tables summarize drilling and production data, and there is a description of drilling and completion practices. G. D. H.

853. International News. Anon. *Oil Gas J.*, 18.3.48, **46** (46), 79.—During 1947, 17 producers were completed at Abqaiq and 3 at Buqqa. Proven area is now 50,000 acres at Abqaiq, and this field produced 53,659,715 brl in 1947.

2 Silvestre in Barinas, Venezuela, has produced at 800 b.d. from Eocene sands at 8600–9400 ft.

A second oil well has been completed 5 miles from Cerro Azul in Veracruz, Mexico.

A wildcat in southeastern Turkey (near Diyarbakir) is swabbing 300–400 b.d. of 15° oil from a depth of 4390 ft. G. D. H.

854. Netherlands Take Oil Spotlight in Review of European, Far East Activities. W. W. Burns. *Oil Gas J.*, 4.3.48, **46** (44), 46.—Schoonebeek's output rose from 1195 b.d. in 1946 to 4000 b.d. in 1947, but the potential at the end of 1947 was 7000 b.d. Production is from a Lower Cretaceous sand on a faulted easterly plunging structure, at depths of 2500–2650 ft. The oil is highly viscous.

Roumania's 1947 production was 78,000 b.d. compared with its peak output of 175,000 b.d. Austria gave 18,400 b.d. in 1947. Most of Austria's oilfields are along a major fault. Production is from the Miocene.

In 1947 Poland's output averaged only 2500 b.d. The output in the Dutch East Indies is rising and averaged 31,000 b.d.; the pre-war figure was 157,000 b.d. G. D. H.

855. Geological Prospecting for Oil in India. J. Coates. *Indian Minerals*, Apr. 1947, **1** (2), 95–110.—An elementary, but fairly comprehensive account is given of the principles and methods employed in the search for oilfields. The mode of formation of an oilfield is briefly described, together with the general characteristics of an oil accumulation. The importance of geological studies and mapping is stressed, while the limitations of such techniques are noted.

The reasons for continued prospecting are indicated. Numerous diagrams are used to illustrate the various points. G. D. H.

Geophysics and Geochemical Prospecting.

856. Airborne Magnetometer. H. Jensen. *Oil Gas J.*, 11.3.48, **46** (45), 89.—The field of application of the airborne magnetometer is described, together with the operational techniques appropriate to surveys of different quality. The factors affecting production rate, costs, etc. are analysed. G. D. H.

857. Airborne Magnetometer Survey Completed. Anon. *Petrol. Engr*, Mar. 1948, **19** (6), 86.—See Abstract No. 248 (1948).

Drilling.

858. Progress of the Drilling Industry. C. W. Alcorn. *World Oil*, Dec. 1947, **127** (8), 98.—A review is presented of developments in: (1) drilling rigs, (2) transportation equipment, (3) drilling bits, (4) coring bits, (5) drill pipe, (6) corrosion fatigue research, and (7) drilling fluids. Three references are appended. R. B. S.

859. Deep Drilling is Finding Oil. E. Adams. *Petrol. Engr*, Feb. 1948, **19** (5), 43.—Out of 144 wildcats and semi-wildcats, 35 new fields or productive sands were found, 10 below 12,000 ft. Costs of deep drilling are high, though tend to decrease as problems of deep drilling are overcome. Increased costs are offset to a certain extent by geological and operational data obtained. A very large number of deep wells are listed and described. C. G. W.

860. Benedum Ellenburger (Texas) Field Developments. K. M. Fagin. *Petrol. Engr*, Mar. 1948, **19** (6), 51.—The well history, progress of the discovery well, and the development of the field are outlined. C. G. W.

861. Deepest Well in Europe. E. Bernadac and E. D. Lynton. *Petrol. Engr*, Mar. 1948, **19** (6), 115.—Puymaurin No. 1 (France) reached 13,268 ft, the deepest drilled in Europe. Equipment consisted of two electric motors 150 h.p. each, one standby 220 h.p. diesel, one 240 h.p. motor on a hand pump. Capacity of derrick 150 tons, height 122 ft. Down to 5900 ft the well was not more than 1° off vertical. Problems were encountered when running casing, and when cementing when the load equalled the derrick capacity, a special cement had to be made for the high bottom-hole temperatures. C. G. W.

862. Technique for Cementing Casing. K. M. Fagin. *Petrol. Engr*, Jan. 1948, **19** (4), 156.—Claims made for this method: (1) full-bore discharge opening from the shoe to the wellbore with the casing shoe suspended a few ft off bottom; (2) complete segregation of cement slurry from well fluids; (3) a piston-like back-pressure valve in the top plug to seal and lock in a stall collar and prevent the slurry from flowing back into the casing; (4) a cementing head or lubricator for placing and pumping cementing plugs into the casing under pressure.

Equipment and operating details are described and illustrated. C. G. W.

863. Hydraulic Pressure Applied to Cement Plugs in Oilwell Casing. W. Moore. *Petrol. Engr*, Feb. 1948, **19** (5), 198.—Cement plugs may be placed in casing for isolating one zone from another, plugging back for testing, shutting off water, or closing off a damaged section. Tests were made to determine the pressure such a plug will stand without movement or leakage. The pressure required increases with the length of the plug to a certain extent. After the plugs begin to move less pressure is required to keep them moving. In one case where a collar recess was provided the pressure connexions blew at 3000 p.s.i. before the plug moved. C. G. W.

864. Diamond Coring of Chert Limestone and Dolomite in West Texas. A. W. McCray. *Petrol. Engr*, Mar. 1948, **19** (6), 64.—Three wells were cored through chert limestone and dolomite formations. No great additional drilling expense was incurred because of coring. Very full drilling data is presented and various phases of coring affecting rate of penetration is discussed. Points discussed are: drilling strings, starting the bit, weight on and speed of bits, drilling fluids, cores obtained, design advances, and an analysis of drilling possibilities. It is concluded: (1) that penetration is not related to mineral hardness; (2) is related to grain size; (3) penetration rate varies with porosity; (4) does not vary with rotary speed between 60 and 120 r.p.m.; (5) is sensitive to increased weight up to a certain point; (6) small constant weight produces better results than larger irregular weights. C. G. W.

865. New Portable Rig is Light and Safe. N. A. D'Arcy, Jr. *Petrol. Engr*, Mar. 1948, **19** (6), 225.—The rig is a semi-trailer unit to drill to 7500 ft with 3½-in drill pipe. Complete with 350 h.p. engine and 96-ft derrick is within the legal road weight and dimension requirements. Developments include remote controls, hydraulic drive to

cabshaft, shaft-drive rotary table drive, hydraulic main drive and sand reel brakes, hydraulic torque converter drive and air clutches. Use of aircraft design and materials reduce the overall weight without sacrificing strength. Points of interest are discussed at length. C. G. W.

866. Wave Action on Structures. W. H. Munk. *Petrol. Tech.*, Mar. 1948, **11** (2), *A.I.M.M.E. Tech. Pub.* No. 2322, 1–18.—The forces exerted on structures by sea waves result from the occurrence of a storm over the ocean with the generation of waves, and these travel from the storm area as swell and break into surf on entering shallow water.

Much more information is available on storms than on the subsequent events. It is, however, possible to forecast wave conditions from weather charts, or to infer past wave conditions from old weather maps. Rational estimates may therefore be made of the wave conditions in a given locality. A knowledge of the wave height and period permits the calculation of the orbital motion of the water, and thence the dynamic pressures exerted by the waves may be derived.

An example is discussed in which the maximum forces and moments exerted against vertical cylindrical piles are calculated. G. D. H.

867. Engineering Characteristics of the Gulf Coast Continental Shelf. M. B. Willey. *Petrol. Tech.*, Mar. 1948, **11** (2), *A.I.M.M.E. Tech. Pub. No.* 2323, 1–11.—Off Louisiana the continental shelf may extend as much as 100 miles out to sea. The sea floor on the shelf varies considerably in form and composition and is made up mainly of sediments, predominantly provided by the Mississippi river. There are sands, clays, mud, and local deposits and reefs of shell. Geologically the deposits are very young.

Few major structures have yet been built offshore in the Gulf, and no comprehensive preliminary tests have been carried out. The results of pile-driving tests are of little value, because actual bearing-capacities greatly exceed the dynamic resistance to driving as determined by conventional formulæ. The materials penetrated are generally cohesive, and their supporting power arises from surface friction. There is a " freezing " action, and this develops with time. In one case a load test after 12 hr rest showed a 75% increase in bearing power. In one instance there was evidence of static friction of 750 lb/sq. ft or more.

The time required and relatively high costs have caused complete load tests not to be made. Such tests as have been made indicate that design loadings could be considerably increased, and it is believed that comprehensive preliminary investigations, including an actual load test, combined with borings and the examination of the materials met by methods employed in soil mechanics, would lead to economies in design and save far more than the cost of the tests. G. D. H.

868. Important Considerations in Marine Construction. F. R. Harris and H. G. Knox. *Petrol. Tech.*, Mar. 1948, **11** (2), *A.I.M.M.E. Tech Pub. No.* 2324, 1–12.—The requirements of the offshore drilling rig are considered, together with the main items affecting the cost of construction. The size and characteristics of sea waves are noted in relation to offshore structures.

Drilling platforms may be considered as fixed, or fixed and floating. The former pattern, either as the conventional cofferdam or pile-supported type, is discussed, with its good and bad features. It is desirable to eliminate as much offshore work as possible where operations are subjected to constant and expensive delay, and to substitute the pre-fabrication of structures ashore or in sheltered waters. Marked economies will come from the standardization of offshore rigs and the provision of special means for transporting them to the site.

Other types of structures are discussed, some being partly pipe-supported and partly buoyancy-supported. Their features are critically discussed. Oil-storage facilities are considered.

The bulk of the discussion is concerned with drilling in water up to 10 fathoms deep. G. D. H.

869. World's Largest Barge-Mounted Drilling Rig. Anon. *World Petrol.*, 1948, **19** (3), 88.—Detailed description of the Shell Oil Co.'s Marine Rig No. 7 is given. The

rig is the largest ever assembled in certain particulars such as horse-power developed, engines, mud pumps, Range 3 drill pipe, and size of derrick. It is designed to drill to 18,000 ft and is capable of being moved from one location to another in the shallow-water area. J. T.

870. Planning a Multiple-well Directional Drilling Programme of Offshore Locations. J. G. Jackson and J. B. Murdock. *Petrol. Tech.*, Mar. 1948, **11** (2), *A.I.M.M.E. Tech. Pub. No* 2325, 1–20.—The many factors, geological, mechanical, and economic, which are involved in planning a directional-drilling programme are discussed and analysed in detail. The planning of a directionally drilled multiple-well artificial island location is a complex operation, and it is essential that the project be examined and defined fully before the programme is begun. Well-spacing in a given sand must be determined, and a decision reached as to whether the sand shall be penetrated vertically or obliquely. If several sands are present the order of exploitation is of importance, and the wells are planned accordingly.

The engineering control necessary to execute a complicated directional-drilling programme is outlined. Various means by which engineering control can be increased, such as cylinder-drilling specifications, are given. A hypothetical example is discussed in which a complete offshore artificial island is to be used for ten wells. By this means attention is drawn to many important factors in the planning. Charts and tables are included for facilitating the drafting of directional-drilling proposals and maps. G. D. H.

871. Factors Governing Rotary Drilling Rates. J. E. Brantly. *World Petrol.*, 1948, **19** (3), 77.—The most important factors responsible for the increase in the rate of penetration of rotary drilling in the period 1932–47 have been the personnel, the improvements in bits and drill pipe, increase in the volume of circulating fluid, and rotating speeds. Improvements in drilling efficiency have taken place since 1939, but not to the same extent as in 1932–39 period. J. T.

872. Care and Use of Cable Tool Joints. F. J. Spang. *Petrol. Engr*, Feb. 1948, **19** (5), 56.—A substantial portion of the cost of drilling lies in the unnecessary failure of tool joints. Factors leading to such failure are corroded or abraded tool joints which prevent proper mating, cross-threading, or stabbing box and pin out of alignment. Failure may also occur due to over-stressing of the joints in making up, causing either deformation or incipient fracture of the joint. Galling, the formation of a hard core by localized friction and heat, is usually due to conditions of use and may be avoided by proper care. The suggested procedure for making up joints to prevent galling and abrasion is as follows: lubricate the joints, apply a slight pressure between the mating surfaces, separate, clean, and relubricate. Re-set with more pressure. Repeat as often as necessary for a perfect fit. Finally re-clean, wet with water, and set with enough pressure for use. Such care, combined with proper prevention of corrosion and abrasion in use and storage, will result in greatly increased joint life.

C. G. W.

873. High Pressure Gas Blowouts Controlled. K. M. Fagin. *Petrol. Engr*, Feb. 1948, **19** (5), 94.—The measures adopted by the Magnolia Petroleum Co. when high-pressure gas from a 6200 ft sand blew out in a drilling well and channelled into a shallow-water sand, causing a series of blow-outs, are described. C. G. W.

874. Mud System Design Cuts Skidding Time. J. C. Albright. *Petrol. Engr*, Mar. 1948, **19** (6), 89.—A permanent installation for handling mud is designed so that each successive well of a series of regularly spaced wells 27 ft apart may be drilled with a minimum number of fittings and connexions to the clutch. The installation consists of a shake assembly shale pit, mud tanks which may be operated separately or simultaneously, and two steam-driven mud pumps. Also in the mud system is a surge tank on the derrick floor used for filling the hole and casing when running pipe. A large overflow line takes excess mud, or the entire circulation, back to the mud pits.

C. G. W.

875. Relation of Water to Drilling Mud. E. C. Page. *Petrol. Engr*, Feb. 1948, **19** (5), 198.—As drilling proceeds to greater depths, mud control becomes increasingly

important. The chemical content of the water used in making up drilling muds is a factor which has been neglected in the past. Experiments indicate that the presence of ions, even in small quantities, has a harmful effect on the mud. Test results are given, and it is concluded that treated water responds more rapidly and more economically to treatment, viscosity decreases more rapidly with the addition of less chemical thinner, and retains the effect for longer than raw water. Proper treatment of make-up water will lessen the occurrence of many common mud difficulties.

C. G. W.

Production.

876. Direct Demulsification of Crude in the Well. N. A. Golubev. *Neft. Khoz.*, 1948, (3), 36–37.—A description is given of simple equipment whereby, using compressed air, a demulsifying agent (crude "Kontakt") is fed to the bottom of the well to break oil–water emulsions. The amount of demulsifier used is 0·5–1% on the total liquid recovered. By reducing the viscosity of the liquid issuing from the well, considerable economy of air is effected where air-lifts are used. V. B.

877. Phase Relations of a Gas-condensate Field at Low Temperatures. C. K. Eilerts, V. L. Barr, N. B. Mullens, and B. Hanna. *Petrol. Engr*, Feb. 1948, **19** (5), 154.—Specific volumes and liquid–gas ratios of a natural gas and four mixtures of condensate with gas were determined in the range −65° to 100° F. Critical temperatures and pressures of the mixtures were recorded. The apparatus consisted of a pressure cell fitted with windows to observe fluid volumes and rocked on trunnions to secure equilibrium. Results indicate that measured values of the critical pressure are about 100% higher than values computed by additive methods and that critical temperatures may be 7% different from computed values. It was found that the critical temperature of separator gas was higher than that of the gas condensate fluid and that the critical temperature was higher the more gas and less condensate the mixture contained.

Compressibility factors and liquid–gas ratios were investigated from atmospheric conditions to conditions of total liquefaction. C. G. W.

878. Temperature Gradients in Gas Lift Wells. R. E. Powers and B. C. Craft. *Petrol. Engr*, Mar. 1948, **19** (6), 118.—Temperature surveys in gas-lift wells may be used: (1) as a substitute for pressure surveys in determining which flow valves are open to production; (2) to locate points of gas entry and casing leaks; (3) to explain increased paraffin deposition in the flow string; (4) to aid in calculating energy of expansion.

Temperature surveys were carried out on two wells using a Humble sub-surface recording thermometer. From the results it is concluded that temperature surveys can be used to find points of gas infection, and that wells produced by gas lift would be expected to show increased paraffin deposition. C. G. W.

879. Restored State Technique Reproduces Reservoir Conditions. Anon. *World Petrol.*, 1948, **19** (1), 64.—Methods and apparatus have been evolved by the Carter Oil Co. for treating cores taken from oil-bearing strata to reproduce conditions existing in the oil reservoir. The rock core is treated with a solvent to remove the crude and is then saturated with brine identical with that of the reservoir. Much of this water is then displaced by the oil under pressure just as in the reservoir the oil had originally displaced the water. The final volumes of oil and water contained in the core are noted. With such information, if the core samples are sufficiently well distributed over the reservoir, it is possible to predict the oil content of the reservoir within a narrow margin of error. J. T.

880. Flowing Dually Completed Wells. T. P. Hoffer. *Petrol. Engr*, Jan. 1948, **19** (4), 111.—Methods of flowing dually completed wells are mentioned. Equipment which permits flowing the lower pay through macaroni tubing and producing the upper formation through the annulus of macaroni and 2-in. tubing provides good utilization of reservoir energy and prolongs the flowing life of a pay. Many operators use the casing annulus for upper-pay production. Corrosion may be serious and calipers for determining casing diameter and depth of corrosion pits are shown. The application of bottom-hole chokes and controls to both pays of a dual completion by using a cross-over-type packer is illustrated. C. G. W.

881. Influence of Spacing on Ultimate Recovery. S. F. Shaw. *Petrol. Engr*, Mar. 1948, **19** (6), 100.—In the Michigan oilfields close spacing has often been practised, the closest since 1939 being 10 acres/well and maximum extraction methods are often employed. Also it is difficult to estimate accurate data on formation thicknesses and porosity and recovery factors, and reserve estimates are therefore not dependable. Results of well spacing and probable ultimate recovery indicate that greater recovery is obtained with close spacing. C. G. W.

882. Detection and Repair of Casing Leaks. W. F. Martin. *Petrol. Engr*, Jan. 1948, **19** (4), 103.—The leak detector consists of a metal cylinder 16 in long with wire mesh formed as a cylinder attached to the lower end of the metal tube over which is placed a skirt of fabric held in place by a rubber band. The device is lowered into the well by Halliburton measuring equipment. When it reaches the casing leak, the pressure differential pulls the fabric into the hole in the casing, stopping the descent of the instrument. After the leak is found a short string of pipe with a packer is run, the packer set 100 ft below the leak with the pipe extending 20 ft below the packer. When the packer is set, the leak is sealed.

The method may be applied to detecting leaks in river crossings when multiple lines are often used. C. G. W.

883. Factors in Selection of Subsurface Sucker Rod Pumps. R. L. Chenault. *Petrol. Engr*, Jan. 1948, **19** (4), 132.—See Abstract No. 63 (1948).

884. Hydraulic Pumpers for Shallow Wells. A. A. Hardy. *Petrol. Engr*, Feb. 1948, **19** (5), 113.—See Abstract No. 64 (1948).

885. Water Flooding of Oil Wells. P. Ya. Polubarinova-Kochina. *Bull. Acad. Sci. U.S.S.R. Div. Tech. Sci.*, 1948, 161–169.—A mathematical treatment; after dealing with the conditions for the movement of a single liquid, the cases are considered of two liquids of varying viscosity and the same density and of two liquids of varying densities and viscosities. V. B.

Oilfield Development.

886. 1947 Drilling Activity. Anon. *World Petrol.*, 1948, **19** (3), 92.—The drilling activity in the U.S.A. in 1947 which set up a new record of 113 million ft is reviewed. Number of wells drilled were 30,825 or 11·8% greater than in 1946. The number of oil, gas, and dry wells also wildcats are compared with those of the previous six years. Of 5830 wildcats drilled, 764 were completed, representing an increase of 16·7% over 1946. In the case of wildcats, 15·5% found oil compared with 13·9 the previous year; 80% were dry compared with 83·4 and 4·5% found gas compared with 2·7. J. T.

887. Oklahoma's First Compulsory Unit at West Edmund. M. K. Neptune. *World Petrol.*, 1948, **19** (3), 64.—A detailed account of unitization of the West Edmund field is given and the producing formations are briefly discussed. J. T.

888. New Petroleum Era Opens for Canada. J. L. Erwin. *World Petrol.*, 1948, **19** (3), 80.—A historical review of the discovery of Alberta fields and also tables of Alberta's yearly production from 1914 to 1947 and monthly production for 1946 and 1947 are given. The production of various fields in Alberta for 1946 and 1947 are compared, and the oil and natural gas production of Canadian provinces are quoted for the same periods. J. T.

889. Intensive Oil Search in Australia. Anon. *Petrol. Engr*, Jan. 1948, **19** (4), 66.—The exploration programmes of the petroleum companies in Australia are outlined. C. G. W.

Transport and Storage.

890. Interstate Lays First Experimental Section of Welded Aluminium Pipeline. P. Reed. *Oil Gas J.*, 29.4.48, **46** (52), 141.—The initial 1200-ft section of the first 6-in aluminium pipeline laid for crude-oil service was laid and tested in the Magnolia,

Arkansas, area, April 1948. An additional half-mile of 4-in aluminium pipe is to be welded on completion of the 6-in section, with further section to follow. These replace steel pipe badly corroded in sour-crude-oil service.

The pipe is made by an "inert-gas arc welding" process which has several advantages, including use of alternating current and water cooling of welding head. Copper–aluminium alloy flanges are used for coupling.

Advantages of using aluminium pipe include lightness and resistance to corrosion.

G. A. C.

891. Borger–Denver Products Pipeline. F. H. Love. *Petrol. Engr*, Mar. 1948, **19** (6), 182.—Construction details of this pipeline are described. Station design, flow formulæ, and hydraulic data are presented in full. C. G. W.

892. Texas–California Pipeline. R. Sneddon. *Petrol. Engr*, Jan. 1948, **19** (4), 116.—Constructional details of the Texas–California pipeline recently completed and opened are given. C. G. W.

893. New Venezuelan Pipeline. Anon. *Petrol. Engr*, Jan. 1948, **19** (4), 152.—This 12-in 103-mile line was constructed in 10½ months. Most of the line is above ground except where passing streams or towns. The line is supplied by 4 gathering stations at 500 p.s.i. and no pumping station is needed. The line is carrying 24,000 b.d. compared with a maximum potential of 70,000 b.d. at 825 p.s.i. C. G. W.

894. Corrosion Prevention Begins with Construction. W. E. Huddleston. *Petrol. Engr*, Mar. 1948, **19** (6), 154.—Complete insulation of pipelines during construction offers several advantages: (1) a substantial amount of corrosion is eliminated that would otherwise be set up due to galvanic action; (2) inception of stray currents will be opposed; (3) with such protection a moderate amount of cathodic protection will afford almost complete freedom from corrosion.

Methods of insulating pipes, casings, and other structures are suggested.

C. G. W.

895. Hydraulic Transfer of Petroleum Products along Pipelines. V. I. Chernikin. *Neft Khoz.*, 1947 (11), 57–59.—Pipeline capacity can be increased by simultaneous pumping of a pet product with water. The inside of the pipe has a spiral screw cut in it or else a spiral wire is laid within the pipe. Oil flows within the spiral and is separated from the pipe wall by a water annulus thus greatly diminishing the pumping pressure required. A brief mathematical treatment of the factors involved is given and it is shown that in the case of a heavy fuel oil the addition of 10% of water would increase pipeline capacity by approx 140 times. In practice, due to turbulent flow and other causes, the increase would be less marked, but still very considerable.

V. B.

896. Metallurgical Properties of High Yield Strength Seamless Line Pipe. A. B. Wilder and J. D. Tyson. *Petrol. Engr*, Feb. 1948, **19** (5), 138.—See Abstract No. 720 (1948).

897. Pressure–Temperature Ratings. Schedule 80 (Extra Heavy) Pipe. W. L. Wilson. *Oil Gas J.*, 29.4.48, **46** (52), 157.—No. 194 in the Refiner's Notebook series tabulates allowable pressures based on Code for Pressure Piping (Section 3) of A.S.A. B.31. Pipe sizes dealt with range from ¼-in to 24-in o.d. The pressures do not apply to power-plant piping, gas and air piping in cities, pipelines, etc. or for steam piping outside power plant. A chart and a table are provided. G. A. C.

898. Electric Arc Welding against Pressure. D. K. Stephens. *Petrol. Engr*, Mar. 1948, **19** (6), 141.—Methods of welding against pressure that have been developed are described. For maintenance purposes and leak repairs, split sleeves or patches are welded over the required section, or with weak sections of pipe lengths of pipe may be split and welded over the weak section. In the case of leaks, a gasket is placed over the leak and a collar and vent pipe welded into the sleeve before welding. After welding a plug is welded into the vent collar. Sleeves and pipes are held in position during welding by a chain and jack.

In replacing valves the line may be cut, the new valve welded in, and then the old valve "bottled" in the open position by welding it into a "tank." Methods of bottling valves on a drip, side-tap valves, installing casing over a line in service, and installing side-gate valves on lines in service are also illustrated. C. G. W.

899. Aerial Line Walking. R. Sneddon. *Petrol. Engr*, Mar. 1948, **19** (6), 208.—Using a Piper Cub aircraft at a 40-ft altitude, line surveying can be carried out over the most inaccessible territories in a very short time. A trained observer can locate minute oil seepages and leaks with great accuracy and certainty. C. G. W.

900. Mobile Radio. W. T. Bulla. *Petrol. Engr*, Mar. 1948, **19** (6), 147.—Two-way mobile radio is a fast, dependable, and adaptable means of communication for conducting pipeline operations. Available frequencies lie in the 30 to 300 mega-cycle region, and of these 1·4 m.cycle are allocated to power, petroleum, etc. Most new installations are frequency modulation, which give comparative freedom from static and other interference. Costs of installations vary from $200 to $400 for walkie-talkie types to $1000–$10,000 for fixed stations. C. G. W.

901. Modern Machine Shop Speeds Repairs. W. E. Nester. *Petrol. Engr*, Mar. 1948, **19** (6), 216.—Machine tools in the shop consist of a 20-in by 18-ft engine lathe, a 5-ft universal radial drill, a 20-in sliding-head drill press, a 10-in precision drill press, high-speed tool grinder, power hacksaw, hydraulic press, and a threading machine. Other equipment and details of the shop are also mentioned. C. G. W.

902. Pipeline Right of Way Maps. E. W. Clark. *Petrol. Engr*, Mar. 1948, **19** (6), 194.—Aerial surveys are increasingly replacing ground surveys for route and location studies in pipeline work. Advantages are: (1) saving in time; (2) more thorough and complete survey; (3) greater overall economy; (4) availability of data not economically obtained by other methods. On the aerial photograph may be superimposed a property ownership map, a topographic map, or other special-purpose map giving a multiple-purpose map. With such maps sufficient data is available for: (1) preliminary planning; (2) preliminary cost estimating; (3) acquisition of right-of-way; (4) field surveys; (5) planning construction; (6) planning maintenance.
C. G. W.

903. Maintenance of Orifice Meters. E. D. Nuneviller and D. M. Considine. *Oil Gas J.*, 15.4.48, **46** (50), 107.—The importance of planning in layout of meter installation and maintenance, including connecting piping, is emphasized.
Instructions for periodic checking of the piping and for cleaning of meter body are given. The effect of dirty range tubes is shown in a figure; a total of eight relative figures are given. G. A. C.

904. Scraper Trap. Anon. *Petrol. Engr*, Jan. 1948, **19** (4), 114.—A scraper trap constructed above ground is described. This avoids the accumulation of vapours from sour crudes, which occurs in manifold pits and sumps. C. G. W.

905. Compressor Stations Add to Line's Capacity. F. H. Love. *Petrol. Engr*, Jan. 1948, **19** (4), 59.—By laying loops, making extensions, and adding new compressor stations, the Tennessee Gas Transmission Co. have greatly increased their throughput. 1600-h.p. compressors have been installed at three stations, six each at two and three at the other. Stations were designed for 45 million cu. ft daily per engine, suction pressure 490 p.s.i., discharge pressure 760 p.s.i. in a single stage. Details of each of the stations are given, and the article is illustrated with photographs. C. G. W.

906. New Compressor Station is Latest Design. H. F. Dawe and W. H. Grontz. *Petrol. Engr*, Mar. 1948, **19** (6), 162.—This compressor station near Lakin Kansas is of latest design and includes a solid adsorbent dehydration plant giving a slow point of 25° F. in entry gas. Seven 1200-h.p. vertical-angle compressors are installed giving a maximum discharge pressure of 900 p.s.i. The equipment and installation is very fully described. C. G. W.

907. Modern Gas Pipeline Compressors. R. L. Boyer. *Petrol. Engr*, Mar. 1948, **19** (6), 199.—Modern high-speed angle compressors are compared with the slow-speed horizontal type. It is estimated that the modern type saves \$40/h.p. in first cost, probably more when considering the entire installation, and is also cheaper in fuel costs. Maintenance costs are believed to be no higher for angle compressors than for horizontal compressors, though the latter are more reliable. The early disadvantage of the angle type—noise—has to a large extent been overcome by precision machining. C. G. W.

908. Semi-automatic Operation of Stations. C. H. Lundt and F. O. Stivers. *Petrol. Engr*, Mar. 1948, **19** (6), 123.—Station design of Humble's 8-in line from Baytown, Texas, to Hearne makes operation semi-automatic. Station buildings contain a pump room and control room separated by a wire-reinforced glass partition. A leucite-topped desk showing a schematic layout of station equipment is the central control point for station operation.

Control equipment includes motor-operated suction and discharge valves on each pump, with a control to shut down the unit and close both valves; pressure and temperature protection, and an automatic vent system; diaphragm valve on the discharge line, which can be controlled by either suction or discharge pressure; a line-discharge pressure switch and sump-bank-level switches. The station alarm system, emergency shut-down system, and other equipment is also described.

Operating sequences for various conditions of operation are described for both terminal stations. C. G. W.

909. Volume Determination of Tanks. T. F. Philliars. *Petrol. Engr*, Mar. 1948, **19** (6), 174.—In the petroleum industry, extensive use is made of tanks of various shapes and sizes. Calculation of the volumes of these tanks is necessary for the preparation of gauge tables. In order to simplify such calculations, the following formulæ were developed: (1) spherical zone formula to give the volume of any part of a semisphere bounded by one or two horizontal planes; (2) conical-zone formula for the volume of any part of a conical vertical section bounded by one or two horizontal planes; (3) elliptical-zone formula for the volume of any part of a spheroid bounded by one or two horizontal planes perpendicular to the axis of revolution, (*a*) for horizontal cylindrical tanks with elliptical ends, and (*b*) for vertical cylindrical tanks with elliptical ends.

Examples of the four general formulæ are given. C. G. W.

910. Pneumatic Method for Gauging Petroleum Storage Tanks. V. I. Chernikin. *Neft. Khoz.*, 1947 (12), 55–56.—A mercury manometer is described whereby the head of oil over an air vent in the tank is balanced against a Hg column. By an additional air vent in the tank, situated $\lesssim$80–100 cm above the first, the manometer may also be used to determine the specific gravity of the stored liquid. V. B.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

911. Corrosion Tests of Heater-Tube Materials for Acid Concentration Service. H. F. Brown. *Oil Gas J.*, 29.4.48, **46** (52), 134.—Results of corrosion studies of various materials used for heater thimbles, acid reboiler and concentrators are presented and test procedures given. Severe corrosion of silicon–nickel alloy thimbles had occurred at one of the Esso Standard Oil Co. refineries. Eleven test runs on cast silicon–nickel alloy thimbles were made in an acid concentrator with different concentrations of sulphuric acid. Glass-coated thimbles were also tested, as were also silicon-impregnated carbon-steel plant.

Results show that cast 12–14% silicon–iron alloy is probably most resistant to corrosion in H_2SO_4, but has disadvantages. Glass-coated thimbles are resistant but fragile, and silver or silver-coated tubes are unsatisfactory when used to transmit heat to the acid. Twelve figures and four tables illustrate the article. G. A. C.

912. Some Experimental Results on the Flow of Viscous Liquids Through a Narrow Diaphragm. A. V. Kruilov. *Bull. Acad. Sci. U.S.S.R. Div. Tech. Sci.*, 1948, 171–186.—Experiments were made, using oil, with pipes of (D) 3 in and 4 in dia fitted with diaphragms of orifice diameter (d) such that $d/D = 0{\cdot}2$, $0{\cdot}3$, $0{\cdot}4$, and $0{\cdot}5$. Tests were carried out both with tubes having normal irregularities of surface and with specially polished tubes. For a Reynolds No. (R) of 100–6000, the irregularity was of negligible effect and with $D > 75$ mm no practical importance is to be attached to tube irregularities except when $R \geqslant 10{,}000$. Curves are given of the discharge coefficient for $R = 100$–$10{,}000$ and the lay-out of the test equipment is shown. The coefficient drops with an increase of diaphragm thickness; when R is below the limiting value it also drops if the aperture in the diaphragm is eccentric to the tube axis. A general expression, valid for the range $R = 100$–$300{,}000$ is derived,

$$\alpha = \frac{\alpha_0(0{\cdot}25 \cdot 10^6 \cdot R + 55 \cdot 25 \cdot 10^6)}{R(0{\cdot}25 \cdot 10^6 + 220 \cdot 88D/d)} + \frac{310 \cdot 15}{R^{1{\cdot}3}}$$

where α = the discharge coefficient sought, α_0 the discharge coefficient when $R \geqslant 0{\cdot}25 \cdot 10^6 \cdot d/D$, and R is the Reynolds No. for the sought discharge coefficient.

V. B.

Cracking.

913. Naphtha Polyforming. R. Guesdon. *Rev. Inst. Franç Pétrole*, 1947, **2**, 608–610.—From a study of published data on naphtha polyforming an estimate has been made of the results which this process would yield when applied to the first cut (38% F.B.P. 210° C) from Iraq crude. The results are given graphically and indicate that when running for a 70 O.N. (Motor method) gasoline, the yield of this (using 0·04% T.E.L.) from the aforementioned cut should be >90%. V. B.

Polymerization.

914. Polymerization to Lubricating Oils of *n*-Heptene-1 and *n*-Pentadecene-1. G. H. Dazeley and C. C. Hall. *J. Soc. chem. Ind.*, 1948, **67**, 22–23.—It has been found when studying the aluminium-chloride polymerization to lubricating oils of the product of thermal cracking of Fischer–Tropsch diesel oil that the higher fractions (b.p. above 170°) gave oils of lower B.A.M. Oxidation Number than the lighter spirit (b.p. up to 170°). In order to discover whether this effect was due to the difference in chain length of the olefins in the polymerization stocks, the aluminium-chloride polymerization of *n*-heptene-1 and *n*-pentadecene-1 was studied.

The results obtained indicate that: (1) the oxidation stability of olefin-polymer lubricating oils is independent of the chain length of the original olefin; (2) by polymerizing α-olefins at temperatures not exceeding 20° no sludge or light oil is formed and a yield of over 90% of lubricating oil can be obtained; (3) the V.I. of oils made from pure *n*-α-olefins is higher than that of oils made from cracked olefins of similar chain length. The V.I. increases with increase in olefin chain-length, and for the C_{15}-α-olefin has a value of 130. C. F. M.

Alkylation.

915. Catalytic Alkylation of Benzene. Yu. L. Khmel'nitzkii, A. I. Doladugin, A. V. Guseva, and M. V. Kropacheva. *Neft. Khoz.*, 1947 (5), 42–47.—Alkylation of benzene (d_4^{20} 0·856, 92% distilled between 79–82° C) was carried out with cracking gases containing 37·9 vol.-% butylenes and 3·6 vol.-% propylene using a phosphoric-acid catalyst mounted on kieselguhr. Reaction temperature was 186–240° C and pressure 15–30 atm. Alkylation in stages gave better yields than single-stage addition of all the olefin fraction. The yield of alkylate (120–180° C) was 57% of theory, which is less than is obtained when propylene is used. Decrease is probably due to higher polymerization rate of butylenes as compared with propylene; alkylate contains appreciable amount of unsaturateds, as shown by iodine value (13–36). V. B.

Chemical and Physical Refining.

916. Nitrogen Removal from Natural Gas (Part I). W. W. Deschner and W. W. Bodle. *Oil Gas J.*, 15.4.48, **46** (50), 76.—A review is given of air and other low-temperature separation methods, and gas dehydration, carbon dioxide and hydrogen sulphide removal.

Nitrogen is a diluent of natural gas and has the effect of reducing the capacity of transmission lines. Nitrogen may be removed by low-temperature liquefaction by fractional distillation; absorption in selective solvents such as hydrocarbons; and adsorption on selective solids.

The Claude system for separation of helium, nitrogen, methane, and heavier hydrocarbons depends for refrigeration on the effect of passing compressed gases through an expansion engine. For separation of coke-oven gas, the Claude or "Air Liquide" process is used, expansion engines being employed for refrigeration, and use of internal refrigeration is not required.

By the Bureau of Mines system, helium is recovered from natural gas, and is the only source of helium.

A process for separation of ethylene from cracker gases is due to Pratt and Foskett.

Refrigeration methods are classified as internal and external refrigeration. The former is achieved by utilization of one of the process streams, the latter is obtained independently of the processing system. Seven figures illustrate the article.

G. A. C.

Metering and Control.

917. Positive-Displacement Metering and Gravimetric Meter Proving on Crude Oil Pipe Lines. J. B. Smith. *Oil Gas J.*, 15.4.48, **45** (50), 80.—A report is given on the installation of, and operating procedures for positive-displacement meters, with some costs, data, and information concerning the accuracy measurement which was achieved.

The meters were on a 10,000 b.d. crude stream at Mantua, Ohio; the oil being of 30–40° A.P.I. gravity and between 35° F and 75° F. No sour crudes were handled. The meters were proved gravimetrically, using a tank on a conventional 10,000 lb capacity platform scale.

It is concluded that meters without temperature compensators are more reliable and accurate than those equipped with them; and that crude-oil metering may be substituted for tank crude-oil measuring without loss of accuracy. Four tables are given, including one showing quarterly throughputs by meters and tanks, and one giving cost estimate for crude-oil meter settings. G. A. C.

Safety Precautions.

918. Pressure-Temperature Ratings. Schedule 40 (Standard) Pipe. W. L. Nelson. *Oil Gas J.*, 8.4.48, **46** (49), 101.—No. 191 in the Refiners' Notebook series gives a table showing allowable pressure in oil-refining and natural-gasoline-plant piping, based on A.S.A.—B31 (Code for Pressure Piping). A formula for computing pipe thickness is also given. G. A. C.

Products.

Chemistry and Physics.

919. Element Structure of Alumina Catalyst. V. I. Oborin. *Neft. Khoz.*, 1947 (11), 50–54.—From examination with a polarizing microscope, it is considered that alumino-silicate catalyst is a mixture of Al_2O_3 and SiO_2 and not a crystalline silicate. Tests with MgO show this to have 98% of the catalyst activity of Al_2O_3. Heating of Al_2O_3 to 1000–1100° C reduces catalyst activity to 8% of original, due to conversion of γ form to the α, the lower activity of the latter being due to the greater inter-atomic distances of the Al atoms. Comparison of the activities of numerous Al catalysts shows that precipitation by NaOH from $Al_2(SO_4)_3$ on silica yields the most effective material. The active form of Al_2O_3 contains a doubtlet with a distance between the centres of Al atoms of 2·56 Å which is very close to the distance (2·51 Å) between the centres of alternate C atoms in a hydrocarbon chain. V. B.

920. Poisoning of Alumino-Silicate Catalyst by Water Vapour. S. K. Makarov and M. A. Kaliko. *Neft. Khoz.*, 1947 (2), 42–46.—Activity of catalyst (as measured by yield of 200° C E.P. gasoline) falls on exposure to water vapour or storage in air and is not fully restored by subsequent heating to 550° C. Heating in an air stream still leaves approx 0·6% H_2O which can only be removed by heating (500–600° C) under vacuum. The conditions under which the catalyst structure is formed by thermal treatment are of considerable importance. It is shown that loss of activity is due to small amount of H_2O adsorbed on the subsurface layer of the catalyst. Absorption of H_2O above a given amount causes no further fall in activity. De-activation can be avoided by using vacuum when structure is formed by thermal treatment. V. B.

921. Gas Dynamic Treatment of Exothermic and Endothermic Discontinuities. D. G. Samaras. *Canad. J. Res.*, 1948, **26A**, 1–21.—This paper attempts to clarify some of the fundamental laws of combustion, although the results and conclusions may be of use for the better understanding of many other problems such as evaporation and condensation. Endothermic and exothermic processes in gas dynamic flows in a very narrow zone are considered as discontinuities. It is found that, in a discontinuity, heat can be added until the exit normal Mach number reaches unity (choking). Depending on the entry normal Mach number, only a limited amount of heat can be added at the discontinuity. An exothermic discontinuity behaves as an expansion, or as a compression shock wave depending upon whether the entry normal Mach number is subsonic or supersonic, whereas an endothermic discontinuity always behaves as a compression shock wave. D. F. J.

922. Catalytic Combustion on Refractories of Exhaust Gases from Internal Combustion Engines. B. A. Zakharov and T. N. Nikolaeva. *Bull. Acad. Sci. U.S.S.R. Div. Tech. Sci.*, 1948, 79–86.—Mixtures of exhaust gases (from a gasoline engine) with air were passed at atmosphere pressure and 300–500° C through a layer of refractory. The linear velocity of flow was 0·15–6 m/sec and the contact velocity 1000–20,000 litres gas/litre refractory/hr. The gases contained on the average 2·5% of CO and 1·5% of H_2; CH_4 was only present occasionally in traces. The ratio of O_2 to the total combustible gases was 4. Reaction chamber was a transparent quartz tube 20 mm diameter and 1 mm long. The refractory used was technical chamotte brick, in grains of 5–7 mm diameter. A diagram showing the layout of the equipment is given. The refractory was activated by oxides of Pd, Cu–Mn, and Fe–Mn. On unactivated brick, combustion was 17% at 300° C and 37% at 500° C. A change of gas flow from laminar to turbulent (Reynolds No. >50–60) causes a decrease in the combustion rate. Under turbulent conditions the order of effectiveness of the activators was Cu–Mn, Pd, Fe–Mn; but when flow is laminar there is no difference between these catalysts. Increase in length of contact layer has the same effect as raising the temperature in assisting complete combustion at high gas-flow rates. It is considered that the Fe–Mn oxides catalyst (10 + 2% on the weight of chamotte) is of sufficient efficacy to be of practical value. V. B.

923. Boiling Points of Compounds of the Paraffin Series (Alkanes). N. S. Kozlov. *Neft. Khoz.*, 1948 (1), 47–51.—A series of coefficients has been calculated, which express the effect, on b.p. of paraffins, of structures differing from normal straight chains. Fundamentally the principal effect is that of branched methyl groups on methyl groups at the end of the chain. A formula of the type $T = T_1 - (An + Bn + Cn \ldots\ldots)$ has been developed where T = b.p. of *iso*-compound; T_1 = b.p. of *n*-compound with the same number of C atoms; A, B, and C are coefficients of the effect of structural factors (or of the mutual interaction of substituted groups) and n is the number of such factors to be taken into account. A table is given comparing the recorded values for the b.p. of 70 *iso*paraffins with the values calculated by this method. Several discrepancies occur, and it is suggested that the literature values for the b.p. of, amongst others, 2 : 3-dimethylnonane, 2 : 7-dimethyldecane, 3 : 6-dimethyldecane, and 2 : 4 : 5 : 7-tetramethyloctane are erroneous, the calculated values being 186·1, 200, 200·2, and 193·6° C respectively. Values forecast for compounds not yet synthesized include 141·3° C for 3 : 4-dimethylheptane and 159·6° C for 3 : 5-dimethyloctane. V. B.

924. Cryoscopic Behaviour of Carbon Tetrachloride. A. W. Davidson, W. J. Argensinger, Jr., and C. I. Michaelis. *J. Coll. Phys. Chem.*, 1948, **52**, 332–333.—The course of the theoretical freezing-point curve for systems in which CCl_4 is the solid phase has been calculated and found to be in accord with experimental data. The reasons for the unusually high heat of transition and low heat of fusion of CCl_4 have been discussed. D. F. J.

925. Ionization Potentials of Some Hydrocarbon Series. R. E. Honig. *J. Chem. Phys.*, 1948, **16**, 105–112.—Ionization potentials are not only of theoretical interest, but may also be applied to practical problems such as the identification of isomers. A new method is described which permits their determination to be carried out reproducibly, within $\pm 0{\cdot}02$ volt, by electron impact in a conventional 180° mass spectrometer. It is shown that an ionization on appearance potential can be determined graphically by drawing a tangent of critical slope to the efficiency curve, which has been plotted on a semilog scale. Absolute values are obtained by referring the unknown to the ionization potential of a calibrating gas. Paraffins, 1-olefins, and 2-olefins show a systematic reduction in potential with chain length. A similar decrease is observed when the mono-olefins are arranged according to the number and size of substituents on the basic ethylene structure. D. F. J.

926. Variation of Latent Heat of Evaporation with Temperature among the Main Homologous Series of Hydrocarbons. M. Kh. Karapet'yantz. *Neft. Khoz.*, 1947 (10) 50–56.—Latent heats of evaporation were calculated by means of the expression $\frac{\lambda}{\lambda_0} = K$ where λ is the latent heat of evaporation of the compound and λ_0 that of a compound chosen as standard, both being measured at temperatures equally removed from the respective critical temperature. Results are given for the *n*-paraffin series up to $C_{16}H_{34}$ (based on hexane as the standard substance), *iso*butane and the 2-methyl substituted paraffins up to 2-methyl nonane (based on *iso*butane), the α-olefins up to C_9 (based on propene) and the naphthenes up to *cyclo*octane (based on *cyclo*hexane). A relationship is also derived, for each series, between K and the number of C atoms in the compound. For all the hydrocarbons examined this can be expressed, with an accuracy of $\pm 3\%$, by $K = 0{\cdot}49 + 0{\cdot}08(n\text{-}2)$. V. B.

927. Fluorine Compounds in Polymerization Reactions. A. V. Topchiev and Ya. M. Paushkin. *Neft. Khoz.*, 1947, (10), 36—45.—A review of work done on the subject, including some previously published by the authors (see Abstract No. 777 (1948)). Compounds of BF_3 are among the more interesting F compounds used as polymerization catalyst. For low-mol.wt. polymers such compounds carry the polymerization further than do sulphuric or phosphoric acids, yielding polymers having a mol. wt. greater than that of the corresponding dimers; some cyclization also occurs leading to formation of saturated hydrocarbons. Such catalyst may therefore be of value in the production of aircraft safety fuels. The BF_3 compounds having most catalyst activity are those with substances, both inorganic and organic, containing OH groups. Polymerization of ethane, propene, and other olefins obtained by cracking, using BF_3 catalyst at 50–150 atm and 20° C yields products within the lubricating-oil range; at low temperatures (−20 to −80° C) and in amounts of 0·1–0·5%, BF_3 causes polymerization of *iso*butene to give compounds of high mol. wt. suitable as lubricating-oil additives. Using diene compounds having conjugated double bonds, rubber-like materials can be obtained. Thirty-eight references. V. B.

928. The C–H Band Energy in Toluene and Xylenes. M. Szwarc. *J. Chem. Phys.*, 1948, **16**, 128–136.—The pyrolysis of toluene and the xylenes were investigated by a new technique which made it possible to study these reactions for degrees of decomposition ranging from 0·01 to a few %. It was shown that these reactions are homogeneous and unimolecular. It was found that the weakest bond in these molecules is the C–H bond in the methyl group. The bond energy of that C–H bond was found to be 77·5 k.cal for toluene and *meta*xylene, 75 k.cal for *para*xylene, and 74 k.cal for *o*-xylene. This data indicates that the resonance energy of the benzyl radical is 24·5 k.cal, and that the hyper-conjunction in *p*-xylene decreases the C–H bond energy in the CH_3 group of this molecule by 2·5–3 k.cal. D. F. J.

929. Specific Heats of Hydrocarbons. A. A. Vvedenskii. *Neft. Khoz.*, 1947 (2), 47–50.—Calculation of the specific heats have been made using an equation of the type $C_p = a + bT + cT^2$. Values of C_p and a, b, and c for the temperature range 27–727° C are given for the *n*-paraffins up to C_8, ethene, propene, 1-butene, 2-butene, pentene, propadiene, 1 : 3-butadiene, *iso*prene, acetylene, methyl-acetylene, dimethyl-acetylene, benzene, toluene, ethyl-benzene, propyl-benzene, xylene (o-, m-, and p-), and mesitylene. V. B.

930. Thermodynamic Properties of Saturated Propylene, Propane, *Iso*butane, *Iso*butylene and Normal Butane. G. H. Hanson. *Trans. Amer. Inst. chem. Engrs*, 1946, **42**, 959–973.—Thermodynamic properties of saturated propylene, propane, *iso*butane, *iso*butylene, and normal butane are correlated and presented in tabular form. Ranges of temperature covered, at 5° F intervals, with the higher being the critical temperature, are: propylene −100 to 196·5° F; propane −70 to 206·3° F; *iso*butane −20 to 274·6° F; *iso*butylene −20 to 292·5° F; and normal butane 0 to 305·6° F. J. G. H.

931. Thermodynamic Properties of Acetaldehyde from Spectroscopic Data. J. M. Smith. *Trans. Amer. Inst. chem. Engrs*, 1946, **42**, 983–988.—Spectroscopic data and the heats of dehydrogenation and combustion of ethyl alcohol are used in the computation of the thermodynamic properties of acetaldehyde in the ideal gas state from 298 to 1500° K. Available data indicates that the values so obtained are sufficiently accurate for engineering calculations. J. G. H.

932. Vapour Pressures of Twelve Four-Carbon-Atom Hydrocarbons. K. Hackmuth, G. H. Hanson, and M. L. Smith. *Trans. Amer. Inst. chem. Engrs*, 1946, **42**, 975–982.—Correlation of the vapour pressures of *iso*butane, *iso*butylene, 1-butene, 1 : 3-butadiene, *n*-butane, trans-2-butene, cis-2-butene, vinyl-acetylene, ethyl-acetylene, di-acetylene, 1 : 2-butadiene, and dimethylacetylene has been made and the results tabulated and presented as a vapour-pressure chart. J. G. H.

933. Interpretation of the Viscosity of Liquid Hydrocarbons by Chemical Kinetics. T. Reis. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 510–518, 553–559, 583–593.—A mathematical discussion based largely on Eyring's theory. After a general introduction the main divisions of the paper deal with chemical kinetics, the theory of holes in the liquid state, a consideration of viscosity viewed as a reaction velocity, and the application of Eyring's theory to hydrocarbons of high mol. wt. Thirty-eight references. V. B.

934. Effect of Surface-active Agents upon Dispensions of Lead Monoxide in Xylene. V. R. Damerell and M. J. Vogt. *J. Coll. Phys. Chem.*, 1948, **52**, 363–367.—The effect of sulphur, lecithin, sodium dioctyl sulphosuccinate, and oleic acid upon the particle-size distribution of lead monoxide dispensed in xylene has been studied. All of these substances were effective in lowering the average size of the particles. D. J. F.

935. Infra-red Radiation From a Bunsen Flame. E. K. Plyler. *Bur. Stand. J. Res., Wash.*, 1948, **40**, 2.—A Perkin Elmer infra-red spectrometer has been used in the measurement of absorption and emission spectra of bunsen flames. LiF, MoCl, and KBr prisms have been used for different portions of the spectrum from 1·8 to 24 μ.

The region from 1·7 to 3·6 μ has been observed under high evolution using the LiF prism. The emission band in the region of 2·7 μ has been resolved into two bands 2·5 and 2·7 μ and a series of 15 lines from 2·8 to 3·1 μ. These emission lines have been attributed to certain rotational states of the H_2O molecule, the separation of the lines, 22 cm^{-1} is too small for changes in energy levels of the OH molecule. A small band at 3·3^2 μ has been observed and is probably produced by CH.

The region from 12 to 24 μ has been measured with a KBr prism, it contains a large number of pure rotational lines of water vapour and two strong bands 14 and 15 μ, which are produced by CO_2. H. A. C.

936. Infra-red Instrumentation and Technique. V. Z. Williams. *Rev. sci. Instrum.*, 1948, **19** (3), 135–178.—This comprehensive article discusses the theory and practice

of infra-red absorption over a wide range of wavelengths. Its main sections include: historical development; techniques and applications in the near infra-red, 2·5–25 μ; instrumentation for the near infra-red; the very near infra-red or overtone region, 0·75–2·5 μ; infra-red photosensitive detectors; far infra-red region, 25–350 μ; microwave region, *ca* 10,000 μ; infra-red gas analysis and filters; and miscellaneous applications of infra-red radiation. The paper contains 210 references.

H. C. E.

937. Influence of Resinous-Asphaltic Materials from Petroleum on the Oxidation of Oils.—N. I. Chernozhukov and A. A. Luzhetzkii. *Neft. Khoz.*, 1947 (5), 48–54.—Petroleum resins obtained from residues and solvent extracts of two paraffinic crudes (Groznui and Kharachukurak) were freed from asphaltenes by suitable treatment with light solvents. The resins were then separated into naphthenic and aromatic components by extraction in neohexane solution (1 : 1) at 45° C with an equal volume of phenol containing 10% water. Elementary analyses of the fractions showed S = 0·27–0·42% and O = 0·41–2·23%. Oxidation tests were carried out, using O_2 in a bomb (150° C, 15 atm, 3 hr) both on the fractions themselves and on a white oil (d_4^{20} 0·878, E_{50} 2·73°) in which they and other additives were dissolved. The oxidized oils were tested for acidity, content in asphaltened and hydroxy-acids (separated by solution in hot alcohol), and acidity of the aqueous extract. The white oil when oxidized alone had an acid value of 33·46 and 13·1% of OH acids. Oxidation of the resins alone caused a rise in acidity to a maximum of 3·97. Addition of 1–3% of the Groznui aromatic resin to the oil has a marked inhibitory effect on oxidation, but 10% is required in the case of the other resins. Comparison with the behaviour of known hydrocarbons suggests that the Groznui aromatic resin consists largely of aromatics having short alkyl side-chains, whilst the naphthenic resins and the Kharachukurak aromatic resin are largely cyclic compounds with long alkyl chains. Examination of the effect of oxidation inhibitors (*p*-hydroxydiphenylamine and sulphanilamide in amounts of 0·01–0·1%) showed that the former is most effective in the presence of resins containing cyclic hydrocarbons with long alkyl chains, whilst the latter is only effective if the resin that is present is composed of aromatic hydrocarbons with short alkyl chains. Sulphanilamide is, by itself, only slightly soluble in mineral oil, and the presence of aromatic resin is necessary to ensure its solubility. Thus, when using additives of the aminophenol type, distillates should be freed from resinous substances having a polycyclic aromatic structure with short alkyl chains, but such bodies should be retained in the oil if inhibitors of the sulphanilamide type are to be employed.

V. B.

938. Thermodynamics of Adsorption from Solutions. I. Molality and Activity Coefficient of Adsorbed Layers. Y. Fu, R. S. Hansen, and F. E. Bartell. *J. Coll. Phys. Chem.*, 1948, **52**, 374–386.—Adsorption *iso*therms have been obtained for a series of graphites of known surface area in aqueous butyric acid solutions. Using these results and the data of Jones and Bury, the molality and activity coefficients of the adsorbed butyric acid have been calculated. The curves of molality *vs* activity coefficient show a sharp break. Arguments have been presented to interpret these curves as indications of multi-layer adsorption, the breaks indicating the completion of the first adsorption layer.

D. F. J.

939. Time Dependence of Surface Tension of Solutions. C. M. Blair, Jr. *J. Chem. Phys.*, 1948, **16**, 113–116.—To explain the slow rate of change of surface tension observed by Addison with aqueous solutions of fatty acids, it is assumed that the adsorption of non-electrolyte solutes in the surface film is opposed by a constant potential energy barrier. A relation between spreading pressure and surface age is thereby developed and is applied to three alcohols. A second relation derived by assuming that the energy barrier is a linear function of spreading pressure is used on Addison's data for *iso*amyl alcohol. It indicates that the spreading pressure dependent portion of the barrier is small and of the same order of magnitude as the energy required to compress the surface film sufficiently to admit the solute molecules.

D. F. J.

940. Viscosity of Solutions and Suspensions. I. Theory. V. Vand. *J. Coll. Phys. Chem.*, 1948, **52**, 277–299.—Taking into account the mutual interactions of the particles

and their collisions, a formula for the relative viscosities of suspensions of rigid spheres has been derived. Constants for the equation were derived for rigid, non-solvated spheres without mutual forces and without Brownian motion. The measured value of the viscosity of a suspension in a given instrument is modified by the presence of walls by the same amount as if along each wall there were a layer of thickness $1{\cdot}301a$, where a is the radius of the spheres, of viscosity of the pure liquid. D. F. J.

941. Viscosity of Solutions and Suspensions. II. Experimental Determination of the Viscosity–Concentration Function of Spherical Suspensions. V. Vand. *J. Coll. Phys. Chem.*, 1948, **52**, 300–314.—The viscosities of suspensions of rigid spheres were measured in a range of concentrations 0–50%. Glass spheres suspended in zinc-iodide solution were used, and the measurements corrected for wall effects. The results compare satisfactorily with the equation derived in Part I. D. F. J.

942. Viscosity of Solutions and Suspensions. III. Theoretical Interpretation of Viscosity of Sucrose Solutions. V. Vand. *J. Coll. Phys. Chem.*, 1948, **52**, 314–321.—The theoretical equation derived in Part I (see Abstract No. 940 (1948)), combined with density data, is applied to solutions of sucrose. D. F. J.

Analysis and Testing.

943. The Measurement of Consistency of Soft Solids and Thickened Liquids. E. B. Clarke and E. W. J. Mardles. *R.A.E. Rept. Chem.* 439, 1948.—Experiments, mainly with penetrometers (cones, rods, spheres, and thin plates), have been carried out to find suitable methods by which the viscosity of industrial materials (paints, emulsions, greases, etc.) at any prescribed rate of shear can be expressed in correct units and in which the degree of accuracy can be assessed. The thin plate, edge on, offers some advantage over other methods and the method is being developed. G. S.

944. Gas Analysis. H. E. Styles. *Auto. Engr*, Apr. 1948, **38**, 153.—A detailed mathematical treatise on the construction of Ostwald combustion diagrams from the values of carbon dioxide and oxygen contents obtained by exhaust-gas analysis. From these diagrams it is possible to estimate percentage-mixture strength and, for ready reference, a monograph, connecting percentage carbon dioxide in exhaust gas, percentage mixture, strength, and percentage combustion frequency, can also be constructed. O. M.

945. Capillary Pycnometer for Determining the Specific Gravity of Gasolines. O. V. Pletneva and Kh. N. Panchenko. *Neft. Khoz.*, 1947, (2), 58–60.—Tests made with an instrument constructed according to the design of Lipkin *et al* (*Industr. Engng Chem. Anal.*, 1944, **16**, 55) showed this to be easy to handle and to give results repeatable to within 0·0002–0·0003. V. B.

946. Action of Some Sulphur Compounds in Gasoline on Copper Strip. A. S. Eigenson and E. P. Toporova. *Neft. Khoz.*, 1948, (2), 47–49.—Refined benzol (total S = 0·03%) had H_2S added and was then diluted to known concentration of H_2S. Tests were then carried out with $CdCl_2$ and Cu strip. Latter reported positive only if a steel-grey, brown, or black colour developed. The $CdCl_2$ tests required a minimum concentration of $5{\cdot}10^{-4}$% whilst Cu strip showed a positive result at $3{\cdot}10^{-4}$%. A second series of tests was made using n-heptane (total S = 0·002%). In this case the limit concentration for detection of H_2S was 10^{-3}% whilst for elementary S it was $5{\cdot}10^{-3}$%, but appreciably lower if traces of mercaptan were present. When only traces of H_2S are present, addition of small amounts of mercaptan can improve the Cu strip test. Mercaptan alone, up to 2·4%, had no effect on the Cu strip, but when using the "doctor" test the sensitivity for mercaptan lies between $3{\cdot}10^{-4}$ and 10^{-3}%. All copper-strip tests were carried out by the standard U.S.S.R. procedure. V. B.

947. Iodine in Brines. (Based on work of Polish Petroleum Institute.) W. Chajec. *Nafta*, Jan. 1948, **4**, 28–29.—Three methods were employed to estimate the iodine content of well Mac Allan II in Eróscienko Nizne: (1) oxidations by Cl_2 to IO_3^-,

dissolution in KI and titration against $Na_2S_2O_3$; (2) dissolving in CCl_4, adding HCl and titrating CCl_4 fraction as before; (3) treating with Na_2CO_3, evaporating to $\frac{1}{4}$ vol, filtering followed by precipitation of NaCl in absolute alcohol (3 vols), addition of conc. KOH, and repeating treatment with alcohol 5 to 6 times. H_2O fraction is made acidic with H_2SO_4. Iodide is dissolved in Cl_4 or $CHCl_3$, and this is titrated against $Na_2S_2O_3$. Values obtained were in gms I′ per litre: (1) 0·02043, (2) 0·0173, (3) 0·02132. Iodine content of other wells were found just under 0·01, but brine from wells in different spas had iodine content varying from 0·00502 to 0·03885. M. S.

948. Vacuum Pumping Equipment and Systems. H. M. Sullivan. *Rev. sci. Instrum.*, 1948, **19**, 1–15.—The construction and characteristics of rotary oil-sealed pumps, ejector pumps, and diffusion pumps are described in detail. Various types of rotary oil-sealed pumps are compared with respect to their free air displacement, pumping speed, and limiting pressure. Similarly, diffusion pumps, in which the limiting pressures are of the order 10^{-7} mm, are compared, and the properties of the oils employed in them are described. The practical application of pumping-speed data and the limitations imposed by connecting tubing of restricted diameter are also discussed. A short bibliography is appended. H. C. E.

Crude Oil.

949. Quantitative Determination of Six-membered and Five-membered Naphthenes in the Light Fractions of Norio Crude. Kh. I. Areshidze and E. M. Benashvili. *Neft. Khoz.*, 1947, (11), 54–56.—Dehydrogenation (after removal of aromatics) over a Pd catalyst at 300–305° C of 4 fractions (60–95, 95–122, 122–150, and 150–200° C) of Norio crude showed that hexahydro-aromatics were present in these fractions to the extent of 8·9, 15·8, 21·4, and 14·0% by weight respectively, whilst the content of pentamethylene compounds was 12·9, 13·5, 23·2, and 61·4%. V. B.

Engine Fuels.

950. Detonation Resistance of Individual Hydrocarbons. M. B. Vol'f and E. I. Zabryanskii. *Neft. Khoz.*, 1947, (12), 35–47.—Engine tests were carried out by the 3-C method on a number of pure (96–99%) hydrocarbons. Rich mixture anti-knock properties were evaluated by the index No. (I.N.). Blending I.N. was determined for mixtures of the hydrocarbons with 4 ml ethyl fluid (containing 49·5% T.E.L.) per kg. The other component of the blend was in most cases a mixture of 85% *iso*-octane with 15% *n*-heptane. The I.N. determined were in the range of −200 (*n*-heptane) to 295 (*cyclo*hexane). Apart from *n*-butylbenzene (117) the aromatic hydrocarbons had high (>200) I.N. With the exception of *cyclo*hexane other six-membered cyclanes had low (23–135) I.N. The I.N. of *iso*octane (2 : 2 : 4-trimethylpentane) was 162. The blending I.N. of aromatic hydrocarbons is markedly influenced by the nature of the second component of the blend, cyclanes and alkanes being much less sensitive in this respect. At rich mixture operation, the aromatic hydrocarbons showed high-lead susceptibility. The relative change in anti-knock properties on enrichment of the mixture can be denoted by the value of tan ϕ, where ϕ is the angle formed by the intersection of a line joining the points of maximum and minimum indicated mean pressure with the abscissa. V. B.

Gas Oil and Fuel Oil.

951. Sea Water Contamination of Boiler Fuel Oil and its Effects. C. J. Gray and W. Killner. *Trans. Inst. mar. Engrs.*, Apr. 1948, **60**, 43.—Pre-war the quality of fuel oil prevented emulsification with water when mixed therewith, but when deep cracking for aviation-spirit production was necessitated by the late war, the constitution of boiler fuel oil changed and, when water displacement and other exigencies resulted in contamination of fuel oil with sea-water, many serious results, such as loss of thermal deficiency, deterioration of furnace refractories, and the formation of bonded deposits in gas passages, were observed.

These defects were proved to be associated with high water content of fuel oil due to emulsification, and work was undertaken to attempt to break these emulsions.

It was established that the presence of soft asphalt enhanced the emulsification properties of a fuel oil by setting up an energy barrier at the oil–water interface, thus reducing the rapidity of breaking of such emulsions and therefore the investigation was directed along the following lines: (*a*) addition of agents to solubilize the asphalt; (*b*) redistillation; (*c*) removal of water by azeotropic distillation with a suitable solvent; (*d*) displacement of asphalt from the interface with a surface-active agent.

Of these (*d*) proved to be the most suitable, and it was found that addition of a specific quantity of surface active agent, based on the water content of the emulsion, coupled with heating to between 120 and 150° F—to enhance the efficiency of collision of water particles—was, in all but the most difficult cases, a satisfactory answer to the problem. Due to easy availability and good results, Teepol was most extensively used in this work, and it was found that additions of about 0·1%, based on water present, produced efficient emulsion breaking. O. M.

952. Industrial Oil Burners. E. T. Wadsworth. *Mech. World*, 1948, **123**, 577–582.—Burners are classified, according to the atomizing medium used, into spray (high-, medium-, and low-pressure air, steam), rotary (revolving cone with low-pressure air), mechanical (pressure jet), and vapour (heat) types. These are briefly described, with sketches of the principal patterns. Main features of combustion chamber design are mentioned. The characteristics of Pool fuel grades are tabulated, together with the air requirements of these for theoretical combustion. V. B.

953. Application of Fuel Oil and Surplus Gas at an Integrated Iron and Steel Works. J. S. Kerr. *J. Inst. Fuel*, 1948, **21**, 165.—A description is given of the use of surplus gas, from coke ovens and blast furnaces, and of fuel oil in the manufacture and finishing of steel.

Fuel-oil firing has been used in three 50-ton "Venturi" furnaces, each producing up to 800 tons per week of high-quality steels. The oil was preheated to 200° F and steam atomized; drawings of the atomizers are given. Details are included of the instrumentation necessary to ensure efficient combustion, and waste-gas analysis data are given. Flame temperatures of up to 1880° C and furnace-roof temperatures up to 1610° C have been observed.

Although it has been stated that sulphur content of fuel oil may be detrimental in steel production, it has been shown in this case that provided combustion is completed before the flame strikes the bath there is no evidence of sulphur contamination.

A comparison of the results obtained with producer gas and oil firing shows that for the latter heat consumption per ton of steel is 25–30% lower. A big item in the saving is the avoidance of gasification losses incurred with producer-gas practice, and due to the high luminosity of the oil flame, increased heat transfer takes place to the bath during the melting and refining periods. The heat saving with fuel-oil firing is, however, insufficient to cover the increased cost of the fuel and the shorter life of the furnace refractories. H. A. C.

Lubricants.

954. Mechanism of Action of Anti-corrosive Additives. S. E. Krein and G. S. Tarmanyan. *Neft. Khoz.*, 1947, (11), 45–50.—Acid value cannot be taken as a guide to the corrosive action of oils on Cu–Pb alloy. Tests show that oleic and palmitic acids are 50–100% more aggressive than naphthenic acids of equal acid value. Oxidation tests of oil containing added naphthenic acid show that, in absence of anti-corrosive additive, attack on Cu–Pb is roughly proportional to acidity developed. Trials with various additives (sulphurized oil, tributylphosphite, and proprietary brands) indicate that their effect is to raise threshold limit of acidity to which oil can rise without serious attack on the metal. Effect of additive is not to inhibit oxidation of oil, but to form protective layer on metal, such layer being continually renewed. Variations of additive effect with type of base oil are due to tendency for polar compounds present in the oil also to form a film on the metal surface. V. B.

955. Mechanical Properties of Greases. G. V. Vinogradov, V. P. Pavlov, and K. I. Klimov. *Neft. Khoz.*, 1947, (12), 47–50; 1948, (1), 52–59.—Tests were carried out on a grease made from a Dossori distillate (5 cs at 210° F) and containing 14·2% of the Ca soaps of cotton-seed oil acids and 2% water. The changes in grease deformation

in a cylindrical viscometer were recorded photographically. At small shear stresses the grease behaves as an elastic solid, the deformation being reversible. At 10° C the shear modulus was $8{\cdot}4 \times 10^{-3}$ kg/mm². Creep can be detected and with a growth of the shear stress there is irreversible deformation. On removing the load the elastic properties, however, soon re-occur, *i.e.*, the structure is restored fairly rapidly. The results obtained can be varied by working the grease. Determination of the threshold value of the shear stress shows that this varies with the direction of grease flow in the capillary relative to the direction of loading; it is independent of the duration of the storage of the grease in the capillary. The thixotropic properties of a 4/1 grease–oil mixture were determined in a rotational viscometer; the results are shown graphically. Flow properties of the grease were measured in a constant-discharge viscometer fitted with a glass capillary. Prior to this test, the grease was passed through a 0·1 mm² mesh sieve. Curves are given relating the discharge to the temperature and pressure for various capillary diameters. Within wide limits the results are independent of capillary length. The maximum press at which tests would be reliable is 50–100 atm; excessive temperature should be avoided, since it may cause loss of water from the grease and also a rise in viscosity is possible owing to changes in the nature of the soap phase. With low pressures and wide capillary diameter, the nature of the flow depends on the latter. Sixty-five references. V. B.

956. Low Temperature Properties of Oils Containing Viscous Additives. N. G. Pushtov. *Neft. Khoz.*, 1948, (3), 49–56.—Tests were made using poly*iso*butylene (P.I.B.) with mol. wt. 6000–30,000 (up to 12·7% for the lower mol. wt. P.I.B.), and Voltol (up to 10%). Blends were prepared with distillate and residual oils having viscosity 13–200 cs at 50° C. Viscosities of blends were determined down to −40° C also pour points and temperature at which fluidity was lost under a head equivalent to 25 cm water. The P.I.B. has marked effect on flattening of viscosity–temperature curve. In the case of a medium viscosity oil (10 cs at 100° C) this increases in viscosity by approx 7500 times at −20° C, but additive-containing blends of similar viscosity only increase in viscosity by 600–900 times. To avoid marked effect on pour point and loss of fluidity the amount of additive should be $\gtrsim 2\%$. The effect of increasing mol. wt. of the P.I.B. is to increase the viscosity of the blend and accentuate the other effects. None of the P.I.B. blends (even when containing as much as 10% of 30,000 mol. wt. polymer) showed anomalous viscosity effects, their flow remaining Newtonian, but such effects were observable with blends containing 2% Voltol, and clearly marked at a Voltol concentration of 5%. Storage tests (14 months) showed no signs of additive separation in any of the blends. V. B.

957. Tendency of Transformer and Turbine Oils to form Low Molecular Weight Acids in the Initial Stages of Oxidation. K. I. Ivanov, N. V. Kleshch, and T. P. Zhakhovskaya. *Neft. Khoz.*, 1947, (2), 50–58.—Numerous oils, produced from Russian crudes by acid treatment, were tested by the standard U.S.S.R. ageing test (30 g oil, glass vessel, Cu + Fe catalyst, air blowing, 140° C, 14 hr, determine acid val, sap val, and ppt) and a modification (120° C, 6 hr, test reaction of aqueous extract) designed to show early formation of low-mol.-wt. acids. It is considered that this latter test gives a reliable indication of the premature ageing of oils. Oils refined normally do not form low-mol. wt. acids, which only occur with under-refined oils and distillates; slight over-refining is not harmful. Low-mol. wt. acid formation is mainly due to resins, which can be removed by additional acid or, sometimes by clay. Reaction products between components of the oil and H_2SO_4 may also be responsible. After-treatment of the oils with clay (10%) can be undesirable and lead to more severe deterioration on oxidation, due to removal of natural inhibitors. Addition of wax (2%) also causes oils to age prematurely. Tests on pure hydrocarbons oxidized by U.V. light in quartz vessels at 70° C for 79 hr with passage of O_2 (1 ml/min for 15 g oil) showed that straight-chain compounds (*n*-decane, cetene) were most easily oxidized, naphthenes (decalin) less easily, whilst aromatics (α-methylnaphthalene) are only slightly affected. It is recommended that the 6-hr test for early acid formation should be used for control purposes by oil producers. V. B.

Bitumen, Asphalt, and Tar.

958. Petroleum Asphalts in Road Building. J. Filippi. *Bull. Ass. franç. Tech. Pétrol.*, 1948, (68), 19–53.—In 1947 400,000 tons of bitumen and cutbacks were used in France, of which 70% was produced by domestic refineries. This proportion will, in 1948, have to increase to 100% in consequence of the prohibition of bitumen imports. In the same year, of 372,000 tons of road bitumen used, 70,000 tons were employed in the pure state, 107,000 in cutbacks, and 192,000 as emulsions. Data is given concerning the French distribution system for road binders, followed by an account in some detail of modern road-making and soil-stabilizing techniques, illustrated by numerous explanatory sketches and photographs. Specifications for bitumens and cutbacks on the French market are included. V. B.

959. Wetfix. Anon. *Rds & Rd Constr.*, Dec. 1947, **25**, 452.—Bituminous binders in addition to coating aggregates for road materials also serve to ensure cohesion between individual particles and so maintain compressive strength, this being reduced by the action of wear and water.

Immersion compressive tests, reproducing the effect of water in the cohesion of bituminous materials, revealed a loss of 56% cohesion on an average of 5 aggregates tested. The use of Wetfix as an additive to the bitumen binder reduced this loss of cohesion to an average of 10% Tests are described of a series of 5 aggregates with bitumen content of the order of 5% with and without the addition of Wetfix.

J. G. H.

Special Hydrocarbon Products.

960. Separation of Butadiene by Azeotropic Distillation with Ammonia. N. Proffenberger, L. H. Horsley, H. S. Nutting, and E. C. Britton. *Trans. Amer. Inst. chem. Engrs*, 1946, **42**, 815–826.—Butadiene is separated from butylenes and butanes by a process of azeotropic distillation with ammonia using the plant and process here described. Azeotropic compositions and vapour-liquid equilibrium data upon which the process depends are given, together with the solubility-phase diagrams of the systems butylene–ammonia and butylene–ammonia–water upon which the ammonia-recovery processes are based. An unusual feature is that the ammonia–hydrocarbon azeotropes at the plant-operating pressure all have the same boiling point.

J. G. H.

961. Production of Sulphurized Cutting Oils by Use of Roll Sulphur. N. V. Golovanov. *Neft. Khoz.*, 1948, (2), 49–52.—The usual method of preparing sulphurized cutting oil was by use of powdered S. The use of lump S has, however, now been found practicable. 600 kg S is blended with 6 tons of black residual oil by mixing for 1 hr at 125° C. The reaction is completed in a separate vessel by heating for 6–7 hr at 160° C. The concentrate thus prepared is cut back at 110–120° C with a spindle oil in the ratio of 1 : 5 yielding a cutting oil with an S content of approx 2%. It is found that unrefined oils retain S much better than refined, in which latter (at 25° C) the purely physical solubility of S is only *ca* 0·2%. Thus S enters into chemical combination with aromatics, unsaturateds, and other active components of unrefined oils. Analysis shows that about 85% of the S is combined as high-mol.-wt. mercaptan. It is suggested that addition of synthetic high-mol.-wt. mercaptans to mineral oils should impart cutting-oil properties to them. V. B.

962. Relationship Between the Viscous Properties of Petroleum Liquids and their Chemical Composition. V. V. Panov. *Neft. Khoz.*, 1947, (10), 45–50.—An examination was made of some Russian brands of petroleum hydraulic fluids (pour points −55 to −76° C) for low-temperature operation. The effect of additives (mol. wt. 6500–18,000) in amount up to 10% was examined. The viscosity of such blends can be denoted by the expression $\log \eta = a'c + \log \eta_0$, where η is the viscosity (cp) of the blend, a' a constant, c the concentration of additive, and η_0 the viscosity of the unblended oil. The low-temperature flow properties can be indicated by the ratio of the viscosity (cp) at −50° C to that at +50° C. A satisfactory hydraulic oil should have I.B.P. 210–215° C, 50% volatile at 275–280° C, and F.B.P. 350–360° C. Aromatic

hydrocarbons should be absent and the content of paraffin side chains (as shown by Waterman analysis) should be $<62\%$; the tendency to cause swelling of rubber is indicated by the an. pt. which should be $<79°$ C. V. B.

Coal, Shale, and Peat.

963. Natural Gas, Coal, Oil Shale as Sources of Liquid Fuels. E. V. Murphree. *Oil Gas J.*, 8.4.48, **46** (49), 66.—Resources of crude oil and raw materials in the U.S.A. for synthetic liquid fuels production are outlined. Based on information derived by or available to Standard Oil Development Co., processing methods are described.

Figures are given for probable costs and material requirements for production of synthetic fuels from natural gas, coal, and oil shale; comparative figures are given for production from crude oil. It is indicated that the cost of producing gasoline from natural gas compared favourably with the cost from crude oil.

There are tremendous reserves of potential oil supplies in the U.S.A., resources of coal and oil shales, and only minor development work is required in the case of oil-shale processing. G. A. C.

964. Interdependence of Coal and Oil. Anon. *Mech. World*, 23.4.48, **123**, 466.—The present world petroleum situation has led to increased activity in investigation of production of liquid fuel from coal. This is particularly true of America where the Fischer–Tropsch process, using water-gas as feedstock, is the centre of interest in this sphere. This step will affect the petroleum industry which, in answer to demand, is concentrating a considerable proportion of its energies on the production of chemicals for plastics and detergent production, many of which were previously derived from coal.

The same situation is largely true of U.K., but it is thought that here more attention should be paid to liquid-fuel production from coal since petroleum must be imported.

Thus it can be seen that, in the future, a balance must be struck between utilization of coal and oil as raw materials for the manufacture of similar products. O. M.

Engines and Automotive Equipment.

965. Art of the Aviation Engine. F. R. Banks. *Flight*, 13.5.48, **53**, 530.—The article describes the evolution of the aviation engine under the headings, Power, Volume, and Weight, Specific Problems, and The Methods of Subsidized Research. I. G. B.

966. Caterpillar Four-cylinder (Diesel) Engine. Anon. *Gas Oil Pwr*, 1947, **42** (507), 431; 1948, **43** (510), 74.—The new type D311 engine has 4-in bore by 5-in stroke cylinders, giving a continuous output of 38 b.h.p. at 1700 r.p.m. and, in certain cases, a maximum output of 52 b.h.p. at 2000 r.p.m. Power, torque, and fuel consumptions are given in the form of graphs, and on the continuous rating the consumption with 45–50 cetane fuel is 0·48 lb/b.h.p.hr. The lubricating system is fitted with series and by-pass filters. H. C. E.

967. Ruston 100 B.H.P. Flameproof Diesel Locomotive. Anon. *Gas Oil Pwr*, 1948, **43** (510), 71–73).—The driving unit of these locomotives is a 6-cylinder four-stroke Ruston 6VRHL oil engine which develops 100 b.h.p. at a top speed of 1500 r.p.m. The cylinders are 4¼-in bore by 5-in stroke with direct-injection combustion chambers, and the liners are of the nickel-hardened cast-iron wet type. A C.A.V. pump delivers fuel to Ruston injectors equipped with edge-type filters and fitted into cast-iron cylinder heads together with overhead inlet and exhaust-valve gear. Cooling water is circulated by a centrifugal pump to the cylinders and exhaust manifold, and is thermostatically controlled. Starting is effected either by hand or by compressed air.

The cooled exhaust gases from the engine are passed through water and then into a spiral chamber which gives them a centrifugal action. They then pass through flame traps, which are readily accessible for cleaning, and out into the air-stream from the radiator fan for rapid dissipation. A flame trap is fitted to the induction side of the engine, and two are inserted in the exhaust line.

Details of the transmission and the mechanical portion of the locomotive are also described, together with its overall dimensions and weight. H. C. E.

968. Fullagar Opposed-piston Engine. B. Reed. *Gas Oil Pwr*, 1948, **43** (510), 75–78.—The R class engines have cylinders 19-in dia and 22-in stroke, with a compression ratio of 12·2 : 1. For the eight-cylinder unit the 12-hr rating is 3275 b.h.p. at a b.m.p. of 65 p.s.i. Indicator diagrams show that the peak pressure under normal running conditions is 605 p.s.i. The mechanical efficiency is 80%, and the thermal efficiency using fuel oil of 19,350 B.Th.U. averages 35·6%. The fuel consumption is 0·37 lb/b.h.p.hr. Details of the injection and firing order in the cycle are given.

Tables are given of power output, peak pressure in each cylinder, and exhaust temperatures under varying loads in the course of seven-day non-stop tests. During these tests lubricating-oil consumption was 1·314 gal/hr, and the cooling water, supplied at a constant pressure of 3·75 p.s.i., increased in temperature from 54° to 72° F during the 7 days. (See also Abstract No. 498 (1948)). H. C. E.

969. Some Problems Encountered in the Lubrication of Steam Turbines. R. Lowe. *Mech. World*, 2.4.48, **123**, 377.—The problem of efficient lubrication of steam turbines under the present conditions of high steam pressure and temperature tending to cause rapid deterioration of oil, is far more difficult than previously when any high-grade lubricant was satisfactory. The difficulty is increased by the necessity of using an oil which, whilst giving a low and flat viscosity curve for ease of pumping, etc., must also produce films of high strength, though the solution of this aspect of the problem lies largely with the turbine designer.

During service, air becomes mixed with oil in the turbine and causes oxidation particularly after shut-down when residual heat can reach the journals by conduction along the shaft, causing the temperature of the oil to rise above 150° F which is regarded as the maximum limit. This difficulty can be overcome by rotating the turbine slowly by means of a barring gear five or six hr after shut-down during which period oil must be supplied at normal pressure by means of an auxiliary pump, thus preventing bearing deformation. Coupled with these precautions modern turbine oils contain anti-oxidation additives which inhibit oxidation of oil.

In spite of increased stability towards oxidation of modern turbine oils, the turbine operator must still observe very many precautions if his set is to function efficiently. For instance, if water gets into the lubricating system, it will corrode metal surfaces and the resulting metallic oxides will act as catalysts for the oxidation of the oil. It is thus advisable to clean out the system periodically and, for this purpose, special detergent formulations having solvent properties for petroleum resins, etc., are available. O. M.

MISCELLANEOUS.

970. California Research Corp. Expands Laboratories in Richmond. H. David. *Oil Gas J.*, 8.4.48, **46** (49), 62.—A review is given of the expansion and modernizing of the Richmond laboratories of the California Research Corpn, a subsidiary of Standard Oil Co., and objectives described.

More than 2 million dollars have been spent during the post-war period. A total staff of 850 persons are employed. Some recent achievements are listed, and include the development of a new process for manufacture of phthalic anhydride and synthetic detergents. G. A. C.

971. France's Energy Problem. J. Majorelle. *Bull. Ass. franç. Tech. Pétrol.*, 1948, (68), 59–87.—A lecture dealing with world energy sources (coal, oil, natural gas, water power) with special reference to petroleum and the situation with respect thereto in Europe and particularly in France. The latter lags behind most European countries in restoring its oil consumption to pre-war level. V. B.

972. Oil and Natural Gas in Hungary. B. Bein. *Nafta*, Jan. 1948, **4**, 30–32.—The history of Hungarian oil production is analysed against the background of political changes. Period I of private search lasted from 1856 to 1906. In Period II (1906–18) there was a State monopoly which discovered gas in Kissármás (900,000 m^3 per day), gas and oil in Bujavica, and oil in Egbell. In 1918 internal consumption of gas reached 76 million m^3. During the following 15 years, (Period III), Hungary

(although without the known oil-bearing territories which she had lost) carried out research in 3 areas: (1) near Budapest; (2) in Tisza region; (3) north of Mátra Mts and N.E. of Bükk Mts. Region (1) gave small quantities of gas; region (2) yielded no oil, but some bromides and iodides; and region (3) traces of oil.

During the following Period IV the Eurogasco carried on the search for oil and discovered four rich fields. 257 wells produced oil and gas at the maximum rate of 838,064 tons a year (1943). Lovászi field is the most productive. Total reserve of crude is estimated at approximately 18,500,000 tons. Gas production reached peak in 1946 of which some is being forced back into the formation, but most of it is wasted (20 million m^3/month). The required rate of oil production causes not only these losses but also a drop in pressure which will undoubtedly prevent fullest recovery of oil in the future. Up to now only small quantities of C_3, C_4, and C_5 fractions are recovered. In the Soviet–Hungarian concession between left bank of the Danube and Roumanian and Yugoslav borders prospecting results are promising, especially in Alföldu. M. S.

973. Manufacture of Activated Charcoal by "Fluidizing." A. Godel. *Chim. et Ind.*, 1948, **59**, 437–439.—A flow diagram is given of a 1500-kg-capacity oven employing a fluidizing technique and operating at a Normandy factory for the production of activated charcoal. The yield of active material is stated to be superior to that obtained by other processes using gas activation of the charcoal. Raw material is sawdust or peat; activation is by steam, mixed with combustion gases, at approx 900° C. A laboratory equipment for evaluating raw materials is briefly described. V. B.

974. Inspection of Aviation Fuels and Lubricants. J. Mason. *Engng Inspect.*, 1947 **2** (3), 7–14.—The administrative outline and organization, details of the A.I.D. set-up for the inspection of aviation fuels and lubricants are described under the following sections: quality of the material at the particular stage concerned; provision of suitable plant to handle the product at all stages; correct manipulation of plant; setting up of an adequate documentation scheme; inspectional work at depots, installations, and laboratories; provision of suitable containers; effects of transit and storage, and the care of products up to the point of actual use. A list of books on aeronautical inspection is included. J. G. H.

975. The World's Airline Figures. Anon. *Aeroplane*, 14.5.48, 74, 569.—Comprehensive details of the operating aircraft companies are given under the headings: Name of Aircraft Company; Staff; Total Mileage; Mileage Flown; Passengers; Passenger Mileage; Mail; Mail Weight; Freight Weight.

The figures are for 1946, the latest year for which they are generally available. I. G. B.

BOOK REVIEWS.

Oil Heating Handbook. H. A. Kunitz. 3rd Edition. London: Constable & Co. Ltd. 1947. Pp. 464 + x. 21*s.* 0*d.*

A nicely produced, profusely illustrated, but somewhat verbose book dealing mainly with automatic oil burners for domestic central-heating boilers, this volume commences with a short description of a typical oil-burner installation for classification purposes and follows with a lengthy, but not very profound Part II on combustion—starting, oddly enough, with a few sketchy notes on oil geology. In Part III, which deals with heating and heating systems, the main emphasis seems to fall on the use of steam, and much of it is hardly appropriate to Britain where practice has tended more and more to the use of hot water. Dr. Oscar Faber and the I.H.V.E. would not think highly of this. Lengthy descriptions of numerous American proprietary control systems are given, all somewhat uncritical and evidently written with a desire to cause no offence. The next section, Part IV, is headed Survey and Installation and consists of detailed instructions to foremen on the surveying and lay-out of domestic oil-burner installations. In so far as it encourages good practice and careful work this is to be welcomed, but it makes the whole business appear far more complicated than it really is.

By this time the reader is beginning to wonder for whom the book is really intended, but the clue is found in Part V, which is addressed to the oil-burner sales manager and finally to his salesman. It includes the ten commandments of salesmanship and a set of not very useful tables of numerical oddities. Maybe in the U.S.A., where selling automatic oil burners is big business, such a book serves a useful purpose. In short it is an excellent volume for American salesman selling American oil burners to Americans, but for 21*s.* all it says and a good deal more can be found elsewhere much better and very much more briefly expressed. G. R.

Industrial Waste Disposal for Petroleum Refineries and Allied Plants. W. B. Hart. Cleveland: National Petroleum Publishing Co. 1947. Pp. 103. $4.00.

This volume consists of twenty articles reprinted from *Petroleum Processing* and its predecessor the Technical Section of *National Petroleum News*, in whose pages they appeared during 1946 and 1947. The articles are divided into five groups dealing with economic and legal aspects, classification, effects caused by escaping wastes, preliminary investigations, and, finally, treatment of wastes containing oil. A bibliography of over 170 references (chiefly to articles dealing with biological aspects of pollution) is appended.

This book makes a particularly opportune appearance as far as British readers are concerned, since the considerable expansion of petroleum refining at present under way in this country will make the problem of refinery-waste disposal of greater importance than in the past. The increased attention that is being turned to the limited water supplies of this small island, of which the legislature has recently shown proof in the Water Acts of 1945 and 1948, is an indication that an even closer control than hitherto will be exercised on industry's use of this natural resource. The awakening consciousness of the value of our water supplies and the importance of preventing their misuse and contamination has been strikingly emphasized in the recent Jubilee Memorial Lecture of the Society of Chemical Industry, delivered by the President of the Institution of Chemical Engineers.

The sections dealing with anti-pollution legislation are, of course, of little direct value to the petroleum industry of Great Britain, but are of interest in indicating how this problem has been dealt with in the U.S.A. where the combination of a much wider area, relatively less industrial activity in the nineteenth century, and the traditional conflict between Federal and State rights led to water pollution enactments being passed at a later date than in the United Kingdom, where this problem had already been the subject of considerable legislation before the turn of the century. It is interesting to see that despite the jealousy with which individual states guard their rights, they have had to co-operate in " compacts " where protection against pollution is concerned, so that a geographical area can be treated as a unit irrespective of artificial boundaries.

The author devotes considerable space to the effects of river and lake pollution

on the animal and vegetable life of such waters, and discusses in some detail the effect of wastes in reducing the available oxygen content of lakes and rivers and thus hindering their self-purification. It may be remarked that there would appear to be a misprint in the heading of Table 1 on p. 27, the temperatures given therein being obviously ranges of upper limits for aquatic life (as correctly stated in the text) and not lower and upper temperature limits.

Since, in Britain, most existent and projected refineries are located close to the coasts, on tidal waters (unlike the U.S.A., where many are inland at considerable distances from the sea), it is possible that a somewhat less strict view could be taken of the biological effects of wastes than where, after leaving a refining centre, a river might traverse many hundreds of miles of country and be an important fishery before reaching the sea.

It is the chapters dealing with practical methods of waste control that are of the greatest value; apart from the social and legal aspect of pollution, it is important to bear in mind that oil, especially imported oil, is valuable, and even fairly elaborate recovery methods will soon justify themselves on purely financial grounds. A description is given of oil-detection devices whereby normally oil-free waters can be treated as uncontaminated and, subject to temperature control if necessary, can be discharged as such, whereas if oil is observed they can be diverted through separation plant. The design of the latter is discussed in several chapters in which the necessary theoretical background of fluid flow and settling rates and the behaviour of oil–water suspensions is covered. Whilst the elaborate oil–water separators described, including sedimentation chambers, are designed to handle a wide variety of oil-containing waters, a design is also given for a simpler type of separator applicable to plants where the oil liable to discharge is low in specific gravity (below 0·825).

The problem of storm run-off water is dealt with and methods for measuring the amount of this in sewers and ditches are discussed. The final chapter is devoted to the handling of emulsion by chemical, heat-treatment, flocculation, and filtration methods.

Despite the comprehensive title of the book, it is actually confined to the handling of liquid wastes and, apart from the bare mention of them, no discussion is given regarding the disposal of acid sludges, spent clays, exhausted catalysts and the like. Whilst the author's remark that these may be frequently considered as raw materials for recovery processes is undoubtedly correct, it is not always possible to apply such methods, particularly in the smaller refinery, and a couple of chapters or so on the solution of problems presented by such materials would have greatly enhanced the value of the book.

Moreover, although the dangers to be expected from the discharge of alkaline and acid wastes is well covered, there is a dearth of practical suggestions for means of dealing with such materials. Here again, whilst recovery processes are the most desirable method, it is not always either practical or economic to put these into operation.

The book must thus be considered, from the practical viewpoint, as being essentially a guide to the handling of waste refinery waters in which oil is present. In this field it can be considered as very complete, and whilst Mr. Hart has of course written his articles (it is presumably the original publication in this form that explains a certain amount of slight repetition that is to be noted in places) from the American viewpoint and with U.S. conditions in mind, this reprint gathers together a valuable amount of information on a specialized topic, and, especially as regards the design of oil interceptors, it forms an extremely useful guide to those concerned with this aspect of refinery operation.

V. B.

BOOKS RECEIVED.

75 Years of Progress in the Mineral Industry, 1871–1946. New York: American Institute of Mining and Metallurgical Engineers. 1947. Pp. 817 + xii.

This book commemorates the founding of the American Institute of Mining and Metallurgical Engineers in 1871 at Wieberbarre, Pennsylvania, and is a record of 75 years progress in the mineral industry. It includes the proceedings of the 75th anniversary of the American Institute of Mining and Metallurgical Engineers which

was held March 17–19, 1947. It has been edited for publication by A. E. Parsons and is sub-divided as follows :

First is a series of reports of 75 years progress in mining geology, metal mining, ore dressing, and other major branches of the mining industry by leading authorities. One report deals with petroleum by E. L. de Golyer and covers almost the whole of the petroleum industry, since 75 years ago the industry was only 12 years old and was confined to the Pennsylvania region. In this article the history of the petroleum industry is sub-divided into the lamp and lubricating-oil period 1859–1900; the fuel-oil or transition period 1900–10, and the gasoline or motor fuel period from 1910 onwards. Advances made in production and refining technique are briefly reviewed.

An account is given of the history of the Institute, together with all its officers from 1871 onwards. The remainder of the book is devoted to a World Conference on Mineral Resources held on March 17, 1947, dealing with world mineral economics, the mineral industry and atomic energy, and a forecast of mineral technology. In this section are included papers by Sir William Fraser on "International Aspects of the Petroleum Industry"; by P. C. Keith on the "Role of the Engineer in the Development of Atomic Energy," and by Robert E. Wilson and J. K. Roberts on "Petroleum and Natural Gas; Uses and Possible Replacements."

Fuel and the Future. London: H.M.S.O., 1948. Vol. I, pp. 370 + vi, 6*s.* 0*d.* net; Vol. II, pp. 374 + vi, 6*s.* 0*d.* net; Vol. III, pp. 211 + vi, 3*s.* 6*d.* net.

These three volumes contain the proceedings of the conference held in London on October 8–11, 1946, under the auspices of the Fuel Efficiency Committee of the Ministry of Fuel and Power.

The first volume is devoted to the opening and closing sessions and the first three technical sessions dealing with the generation of steam, steam utilization, and heat for drying. In the second volume the subjects covered are high-temperature processes, the carbonization and chemical industries, the light and heavy clay industries, the railways, and the coal industry. Volume three deals with modern heating and the architect, and the home and its fuel services, together with a joint session on district heating.

Gas Facts—A Statistical Record of the Gas Utility Industry in the United States, 1945 and 1946. New York: American Gas Assoc. 1947. Pp. 166 + x. $1·0.

A collection of valuable statistical information regarding reserves, production, transmission and distribution, sales and utilization, finance, labour, and prices of manufactured, natural, mixed, and liquefied petroleum gases in the United States. This is the first edition of what is to be an annual publication by the A.G.A.

Petroleum Facts and Figures. 8th Edn. New York: American Petroleum Institute. 1947. Pp. 236.

After a lapse of six years caused by the war, the appearance of this volume of statistical information regarding the petroleum and allied industries is very welcome. Mainly concerned with the position in the U.S.A., some world figures are included in regard to production and consumption.

German Intelligence Reports.

B.I.O.S.

1033. Oilfields Investigation in Italy. Pp. 42.
1587. Drying and Filtration in the German Chemical Industry.
1612. Fundamental Work on Combustion in Germany. Pp. 172.
1672. Thermal Measuring Instruments, Thermostats and Associated Apparatus. Pp. 57.
1737. Continuous Chlorination of Benzene Process at I.G. Farbenindustrie, Bitterfeld and Wolfen, for Manufacture of Paradichlor Benzene as Primary Product. Pp. 8.
Misc. 71. German Diesel Fuels. Pp. 30.

F.I.A.T.

1311. The Manufacture of Ethylene Glycol, Polyglycols, Glycol Ethers, Ethylene Cyanhydrin and Acrylonitrile, Phenyl Ethyl Alcohol and Related Derivatives of Ethylene Oxide in Germany. Pp. 76.

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Oilfield Exploration and Exploitation.

Geology.

976. 1947 Oil Discoveries Largest since 1937. H. J. Struth. *Petrol. Eng.*, Jan. 1948, **19** (4), 51.—10,866 exploratory wells were drilled in U.S.A. in 1947, and reserves thereby discovered were about 1,860,000,000 brl. New discoveries together with re-appraisal of fields found in the past eight years may have made the total addition to reserves in 1947 about 3,260,000,000 brl. At the beginning of 1948 underground reserves were estimated at 23,344,000,000 brl.

Wildcat drilling costs in 1947 averaged $66,000 per well including dry holes; the 1935 figure was $12,310. In 1947 the new oil discovered, exclusive of revisions, is estimated to have cost 59 cents/brl. Over the past thirteen years price of crude has been a strong influence in determining exploratory activity. In 1947 the average reserve addition per discovery wildcat was 800,000 brl; for all exploratory wells the addition was 175,000 brl/well.

In 1936 new fields and extensions added 1,763,000,000 brl to reserves, but subsequent revisions added a further 2,000,000,000 brl.

There are indications that currently oil-finding costs are over six times the 1935–38 figure of 7·9 cent/brl. In 1946–47 twelve dry holes were drilled for each million barrels of oil discovered; the figure for 1926–30 was two dry holes.

During 1946 total natural-gas discoveries, including revisions and extensions, totalled 17,729,152,000,000 cu. ft. Natural gas reserves are estimated to be equivalent to 17,900,000,000 brl (allowing 10,000 cu. ft/brl). Natural-gas liquids are placed at 2,500,000,000 brl, and together with crude oil (23,344,000,000 brl) and the natural-gas equivalent, the U.S. petroleum reserves become 43,744,000,000 brl.

Tables show exploratory expenditures in 1947, the number of exploratory wells drilled and the price of crude each year from 1935, drilling and exploratory results in 1944 to 1947, the approximate cost of finding oil each year from 1935, the petroleum-reserve position and the wildcat discoveries yearly from 1935, the results of the exploratory effort, and the dry-hole–reserve relationship for various dates. G. D. H.

977. Wildcat Drilling Highest Despite Handicaps. Anon. *World Oil*, Feb. 1948, **127** (11), 134.—5539 exploratory tests were completed in the U.S.A. in 1947; the 1946 figure was 4947. 1130 of the 1947 tests succeeded, 932 finding new oil, gas, or distillate sources, and 198 extending production in known fields. 556 new fields were found in 1947, comprising 424 oil fields, 88 gas fields, and 44 distillate fields.

A table summarizes the discoveries yearly from 1937 giving new fields and new pays in the oil, gas, and distillate categories. Data on productive and unproductive tests are given by States and districts for 1947. G. D. H.

978. Wildcatting Success Shows Gain for 1947. Anon. *World Oil*, Feb. 1948, **127** (11), 142.—14·7% of the wells completed in the U.S.A. in 1947 were wildcats, and of these 11·5% were successful. 9·8% of the 1946 wildcats were successful.

A table gives by States and districts the total new wells and strict wildcats drilled in 1947 and in the period 1937–46, together with the numbers and percentages of wildcats which were successful. G. D. H.

979. Mississippian Marshall Formation of Michigan. V. Brown Monnett. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 629–688.—This paper comprises a lithologic study of the Marshall formation which is confined to a gentle structural basin in the southern peninsula of Michigan. It directly underlies the glacial drift in a circular outcrop zone and overlies the Coldwater shale. The eastern sandy facies of the latter formation is inseparable from the Marshall formation at most places.

The top of the Marshall grades into the Michigan formation, and the Michigan "Stray" sandstone is the result of an interfingering of the Marshall and Michigan deposits. Although the Michigan "Stray" sandstone is the largest gas reservoir in Michigan, no commercial oil or gas has so far been found in the Marshall formation. E. N. T.

980. Montana Lease Play Stirred by Canadian Discovery. Anon. *Oil Gas J.*, 29.4.48, **46** (52), 171.—The Pincher Creek discovery well produced 9,000,000–12,000,000 cu. ft/day with 328–350 b.d. of condensate from the Madison. A second well is to be drilled 7 miles north and 4 miles west of the discovery. G. D. H.

981. New Mexico Pre-Permian Strike Draws Wide Interest. Anon. *Oil Gas J.*, 13.5.48, **47** (2), 443.—Pre-Permian oil production has been found in northern Lea County, New Mexico (SW.SE 27–9s—36e). The producing section is at 12,115–12,215 ft, and in a 6-hr test 995 brl was produced after acidization. The top of the Pennsylvanian is placed at 5472 ft, and the top of the Ellenburger at 8072 ft. G. D. H.

982. Slick–Urschel Finds Deepest Ellenburger Production. Anon. *Petrol. Eng.*, Jan. 1948, **19** (4), 160.—Nine miles north of Big Lake, in Upton–Reagan County, Texas, Alford No. 1 has shown oil and gas saturation in the Ellenburger at depths between 11,020 ft and 12,022 ft. Eleven drillstem tests showed oil and gas, and after perforation and acidization in this section the well had a potential of 888 b.d. on a ¾-in choke, the gas–oil ratio being 4000. High gas pressure was met in the Pennsylvanian, and a drillstem test at 9410–9494 ft recovered 6000 ft of oil. The Devonian was topped at 10,010 ft and the Silurian at 10,600 ft. G. D. H.

983. Bloomington Field, Victoria County, Texas. Anon. *Oil Gas J.*, 29.4.48, **46** (52), 138.—Production is obtained from the Greta Massive (4600–4700 ft) and the Frio (4900 ft). Data are given on drilling conditions, casing, bits, contract terms, and the operating companies. G. D. H.

984. West Texas Transitional Zone Gets New Discovery. Anon. *Oil Gas J.*, 26.2.48, **46** (43), 171.—Seven miles south of Sterling City, Sterling County, West Texas, a well has flowed 28·5° oil at the rate of 28 brl/hr, with a gas–oil ratio of 106–175 cu. ft/brl. The producing horizon is in the Wichita–Albany or the Wolfcamp. The well is intended to test the Ellenburger. This well probably lies in the transition zone between the west flank of the Bend Arch and the Midland black shale basin. G. D. H.

985. New Petroleum Era Opens for Canada. J. L. Irwin. *World Petrol.*, Mar. 1948, **19** (3), 80.—Leduc was opened in February 1947. Oil is obtained at 5050–5350 ft from the Devonian. The reserves are estimated as 100,000,000 brl. If Woodbend is part of the Leduc area the field is 7 miles by 4½ miles.

The Lloydminster area output is expected to exceed 1,000,000 brl/year by the end of 1948. This area produces from a Cretaceous sand above the Devonian limestone.

At Bantry, 12 miles southwest of Princess, oil has been found in the Cretaceous. The well was taken down to the Devonian. In the Pincher Creek well a gas flow of 10,000,000 cu. ft/day has been met, and there is evidence of a light crude.

Alberta has extensive gas reserves. At Staples, Essex County, Ontario, a well has found a gas flow of 300,000 cu. ft/day, with 6 brl of 38° crude. A field covering about 2000 acres is indicated.

Canada produces only 7·2% of its oil requirements. G. D. H.

986. Leduc Celebrates First Birthday. C. O. Nickle. *World Oil*, Mar. 1948, **127** (12) 223.—Forty-seven wells have been completed at Leduc (Alberta) in a year, forty-two being successful, with open-flow potentials of 300–3000 b.d. The eastern edge of the field is limited by five failures. Two zones in the Devonian produce; the upper zone is a limestone with a porosity pinch-out to the east and northeast; the lower zone, at 5150–5400 ft, appears to be a reef. At the end of 1947 the proved area was 8400 acres, with reserves of 80–120 million brl.

Woodbend 1, 3 miles northwest of Leduc's producing boundaries, had an initial potential of 2200 b.d. It may represent an extension of Leduc or a second field of the same type. Leduc is estimated to have produced 550,000 brl in its first year. G. D. H.

987. Canada in Midst of Greatest Exploration Play in Dominion's History. C. J. Deegan. *Oil Gas J.*, 29.4.48, **46** (52), 150.—The belt of possible oil-bearing territory

lies between the Rocky Mountains and the pre-Cambrian, being 800 miles wide at the U.S. border and 150 miles wide at Fort Norman. There is about 650,000 sq. miles of sediments, largely marine, and 1000–13,000 ft thick. The area has a number of oil and gas fields, and the Athabaska tar sands. Fort Norman produces from a Devonian reef, and 900 miles to the south, at Leduc and Woodbend, there is further Devonian reef production. Much of the area will require wells less than 7000 ft, or less than 5000 ft in depth.

The area of the present play, bounded in the north by climatic and general development conditions, covers about 100,000,000 acres in Alberta and 40,000,000 acres in Saskatchewan. G. D. H.

988. Petroleum Possibilities along Eastern Front of Southern Andes. G. M. Ruby. *World Oil*, Mar. 1948, **127** (12), 215.—Within the stretch from the Tupungato field of Argentina to Tierra del Fuego there are four distinct oil basins. Mendoza is the most northerly of the Patagonian embayments. The Cacheuta field has seeps, and produces from lenses north and down-dip from the outcropping Rhaetic oil sands. The structure has a granite core. To the south, the beds thicken and at Tupungato the Rhaetic is covered by tuffs (probably Jurassic), and these provide the reservoir rocks. Cacheuta and Tupungato are on the same general uplift. To the east is another oil-bearing line of uplift.

South of the Rio Diamante and north of the Rio Colorado are folds with Upper Jurassic shales and gypsum. It seems that the Upper Jurassic and Lower Cretaceous shales are oil-bearing, but there is a general lack of possible reservoir rocks. To the south is a large sedimentary basin covered by Upper Cretaceous beds. Near the foothills the folds trend north–south and are very young; the pre-Andean folds tend to be east–west. The basin has at least four major unconformities. It is attractive for further prospecting.

Near the western limit of the Comodoro Rivadavia basin are two large anticlinal uplifts, on which it is seen that the lower tuff series grades imperceptibly into the oil-bearing strata. The lower tuffs have Jurassic fossils. Wells on the uplifts have had oil and gas shows. The oil-bearing series is unconformably overlain by beds of late Upper Cretaceous age.

At Spring Hill there is a complete Upper Cretaceous sequence, and this includes source beds, but lacks reservoir beds. They have provided oil in the 100-ft sand below, which is derived from Jurassic tuffs. G. D. H.

989 Two Wildcats Started by Chilean Government. *World Oil*, Mar. 1948, **127** (12), 236.—A well is being drilled at Espora, 10 miles due north of Spring Hill, possibly on an extension of that field. Spring Hill reserves are placed at 20,000,000 brl. 40 miles southeast of Spring Hill a well is to be drilled at San Sebastian.

Six wells were completed at Spring Hill in 1947, four giving oil and two gas.
G. D. H.

990. Completion of Thirteenth Spring Hill Test Expected. Anon. *Oil Gas J.*, 29.4.48, **46** (52), 61.—Six oil wells, four gas wells, and two dry holes have been completed at Spring Hill, Chile. The oil wells have an average potential of about 500 b.d. each. At Espora, 5 miles north of Spring Hill, and at San Sebastian, 50 miles south of Spring Hill, wildcats are under way. G. D. H.

991. Oil Companies Losing Interest in Peru as Oil Law Stays Mired in Politics. Anon. *Oil Gas J.*, 29.4.48, **46** (52), 62.—The passage of an adequate oil law in Peru is still being held up. This has led to loss of interest in the Montana.

In 1947 the Oriente Co. completed a dry hole in the Contamana area, and planned a second wildcat on the Pisqui anticline. The output of Peru in 1947 averaged 34,966 b.d., compared with 48,000 b.d. in 1946. Seventy-three development wells and twenty-nine exploratory wells were drilled in the La Brea–Parinas concession in 1947. The exploratory wells yielded seven oil producers and three gas wells, three new pools being opened.

The Zorritos area gave 320 b.d. and the Lobitos–El Alto area 6361 b.d. in 1947; Ganzo Azul averaged 323 b.d. mainly for use in eastern Peru.

1 Rayo (Oriente Co.) on the northern end of the Contamana anticline penetrated

Lower Cretaceous, and Upper Jurassic, and entered the basement without finding any shows. 5·4 miles to the west the Santa Clara well reached a total depth of 850 ft in the Lower Cretaceous. G. D. H.

992. Oilfields of Royal Dutch-Shell Group in Western Venezuela. Anon. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 517–628.—The Royal Dutch-Shell Group at present operate eleven oilfields in Western Venezuela through the Caribbean Petroleum Co. These fields are located in the State of Zulia, in the Maracaibo Basin. They are Cabimas, Tia Juana, Lagunillas, Pueblo Viejo, Bachaquero, Mene Grande, Concepción, La Paz, Tetones, Las Cruces, and Los Manueles. The first five of these fields are usually referred to as the Bolivar Coast Fields on account of their location in the Bolivar District on the east shore of Lake Maracaibo, but are actually parts of one very large field in which accumulation took place under similar stratigraphical and structural conditions. At the end of 1945 the eleven fields described in this very comprehensive report had produced a total of 1181 million brl and still had a daily potential of 250,750 brl. If the oil produced by the Mene Grande Oil Co., the Creole Petroleum Corpn, and the Colombian Petroleum Corpn is included, the total production of the Maracaibo Basin to the end of 1945 was 2,634·5 million brl, and the average daily production in the last week of 1945 was 648,450 brl.

The geological history of the Maracaibo Basin is intricate and still only partly known. Its shape is mainly the result of the Andean Orogeny, and mountain systems of Andean age border it on three sides. On the north, the basin is bordered by a foreland, which was not involved in the Andean folding and is to-day represented by the Goajira and Paraguana peninsulas and the islands off the Venezuelan coast. Very little is known of the tectonics inside the basin, but in general the structures follow the trend of the nearest segment of the surrounding Andean system.

The Bolivar coastal fields are described in detail. Much attention has been given to the stratigraphy of the Miocene sands, which have given 99% of the oil produced by Venezuelan Oil Concessions Ltd in this area, the remainder coming from the Eocene. The most important stratigraphical feature here is the unconformity along which the Miocene transgresses on to the Eocene, which has played a major part in the accumulation of oil. The structure of the Bolivar coast fields can be described as two broad synclinoria separated by the narrow Pueblo Viejo uplift and affected by a south-southeast-striking fault system.

The Mene Grande field of the Caribbean Petroleum Co. is situated on the eastern side of Lake Maracaibo in the district of Sucre, State of Zulia, on the south plunge of the Misoa anticline. The productive Miocene formations are exposed just north of the field, and the large seepages here first drew attention to the area. Drilling started in 1914, and in 1925 oil was found in the Panjí formation of the Eocene. Subsequently, production was also obtained from the Misoa–Trujillo formation of the Eocene. The structure of the field can be described as a south-plunging asymmetric anticline, with a steep, strongly faulted west flank. A total of 495 wells had been drilled in the Mene Grande field at the end of 1945, of which 270 were actually producing. All the oil produced in the Mene Grande field is pumped to San Lorenzo through two 8-in pipelines. The refinery at San Lorenzo has a throughput of 30,000 b.d. Surplus crude and some refined products are shipped to Curaçao.

The Concepción field is situated 15 miles west of Maracaibo on a peneplain approximately 230 ft above sea-level. Drilling was started in 1924 for geological reasons, since there are no seepages in the neighbourhood, and was finally suspended in April 1944 due to the decline in production of the wells. The structure is a steeply folded anticline which is strongly disturbed by longitudinal faulting and some cross faults, which divide the field into five main structural units. Oil and gas is produced from Eocene sands, which are classified as Upper, Ramillete, and Punta Gorda sands. A total of 147 wells had been drilled in this field at the end of 1945, of which ninety-three were still producing.

The La Paz field is in the Maracaibo District about 12½ miles west and slightly north of the Concepción field. It was discovered as a result of geological investigations, aided by conspicuous seepages. Drilling began in 1922 and was continued with breaks to 1944, when a test discovered a prolific oil accumulation in the Lower Cretaceous. The structure is a crest-faulted, southwest–northeast anticline with a steep northwest flank, whose crest is shattered by a series of longitudinal faults which dip sharply

southeastwards. Most of the oil has been obtained from the relatively shallow Eocene and Gusare (Upper Cretaceous) formations, but deeper accumulations are probable. A total of ninety-one wells had been drilled in this field at the end of 1946, of which forty-eight wells were actually producing.

The Tetones field is situated in the Mara District about 18 miles north of La Concepción. A wildcat drilled in 1945 found prolific Cretaceous production, and by the end of 1946 five wells had been drilled with a total daily capacity of some 20,000 brl. The stratigraphical and tectonic conditions in this field are similar to those at La Paz, but the details are still obscure.

The Manueles and Cruces fields are situated on the so-called Tarra anticline approximately 62 miles from the southern extremity of Lake Maracaibo. The fields were discovered by geological investigations, and drilling was begun in the Cruces field in 1916 and at Los Manueles in 1926.

The Tarra anticline is a notable fold, some 46 miles long at the surface. Near the Colombian border, the anticline is asymmetric with a steep to overturned west flank and a gentle east flank, which is complicated by a thrust fault which shows a westerly thrust movement. The Tarra thrust, which has been mapped over a length of 14 miles, has strongly influenced accumulation in the Cruces field. The Manueles field is an axial accumulation on the Tarra anticline about 9 miles north of the Cruces dome.

The following members of the stratigraphical sequence can be classed as actual or potential reservoirs in the Tarra fields: Tomón, Cogollo, and La Luna formations; Third Coal formation; Mirador formation and Sandy Shale formation.

A total of 166 wells had been drilled in the Cruces field at the end of 1945, including some outlying wildcats, of which ninety wells were producing. In Los Manueles a total of thirty-eight wells had been drilled of which nineteen were producing.

The paper is concluded by a discussion on the probable origin and accumulation of oil in the Maracaibo Basin. In some cases it can be established fairly accurately whether the oil found in a formation is indigenous or otherwise, but more often only speculation is possible.

Some 93% of the total oil produced up to the end of 1945 from the fields reviewed has been derived from Miocene rocks, 6% from the Eocene, and only 1% from the Cretaceous. These relative proportions have markedly changed in recent years, so that current production is estimated as 15–20% from the Eocene and 6% from the Cretaceous. E. N. T.

993. Exploration Spurred by Showings in Southern France. E. M. Tiratsoo. *World Oil*, Apr. 1948, **127** (13), 215.—Oil was recently discovered at Audignon in S.W. France, on an anticline with a thrust fault on the southeast. The oil is in a dense oolitic limestone, possibly of Jurassic or Triassic age, at 7049 ft. Swabbing has given 12–15 b.d. of 22° asphaltic oil.

The central part of the basin at the foot of the Pyrenees has salt plugs, and there are hopes of production from the Middle and Lower Cretaceous and Jurassic or deeper. Gas shows were found in wells on the Garlen and Saint Medard structures after drilling into the Trias. The northern part of the area seems most favourable for pre-Cretaceous oil accumulations.

The southern part may produce from the lower part of the Upper Cretaceous where there is Flysch cover.

Not all the tests of geologically and geophysically found structures have been drilled to conclusive depths. G. D. H.

994. Germany's Stepped-up Exploration Yields Little New Oil. Anon. *World Oil*, Apr. 1948, **127** (13), 237.—Twenty-eight exploratory wells were drilled in Germany in 1947. New producing zones were found in some known fields, and others were extended. Promising oil and gas shows were found in wildcats in the Hanover and Emsland districts.

348,776 ft was drilled in northwest Germany in 1947, 142,197 ft being exploratory. Nineteen wildcats were in the Hanover area, three in Schleswig-Holstein and six in the Emsland area. A well at Wesendorf has been completed in the Lower Lias at 5970–6070 ft. A further well in this field extended production in the upper horizons over 1 mile. Eilte 4 between the Steimbke and Hademsdorf fields produced some heavy oil and then went to salt water. Traces of oil have been found in shallow holes

on an anticlinal feature north of the Nienhagen–Eicklingen salt domes. Between Nienhagen and Gifhorn a well had shows in a series of Jurassic and Cretaceous horizons, but was finally abandoned because of mechanical difficulties. Between Calberlah and Oberg a well had slight oil shows in the Valendis. Shows in the Muschelkalk and Bunter were found in Itterbeck 2, on an anticline near the Dutch border. Northeast of Emlicheim, shows were found in the Wealden and Upper Jurassic. G. D. H.

995. French Morocco Discovery Most Important in Africa Outside Egypt. N. A. Kendall, *World Oil*, Mar. 1948, **127** (12), 230.—Three sedimentary basins in French Morocco are of interest in oil exploration—the Miocene basins of Rharb and Guercif-Mouilouya, and the Cretaceous basin of Chaouia. The first has strong folds, and wells have penetrated a Mesozoic sequence in the east and northeast. A little production was found at Tselfat and Bou Draa, and a small commercial output was established in thin Miocene sands at Ain Hamra. The Miocene rests on basement Palæozoic.

Oned Beth 7 is said to be capable of producing 1275 b.d. from a structure with Miocene overlying a Palæozoic buried hill. G. D. H.

996. Commercial Production Indicated in Turkey. Anon. *World Oil*, Apr. 1948, **127** (13), 244.—A well on the Ramandag structure has swabbed 15°-gravity oil at 300–400 b.d. from 125 ft of Eocene limestone. Seven wells have been drilled on this structure, and an earlier well pumped small amounts of oil.

On the Adana structure core holes 300–1000 ft deep, drilled some years ago, had oil shows. G. D. H.

997. International News. Anon. *Oil Gas J.*, 13.5.48, **47** (2), 198.—A well at Kariana, New Guinea, has been abandoned at 12,621 ft. Locations have been selected at Upoia, Hohoro, and Orio.

1 Blafaion in Syria was in the Judea limestone at 6299 ft, while 1 Dola was coring limestone and black shale at 4765 ft. G. D. H.

Geophysics and Geochemical Prospecting.

998. Geophysical Activity Increased as Year Begins. Anon. *World Oil*, Feb. 1948, **127** (11), 158.—At the end of 1947, 529 geophysical and core-drilling crews were searching for oil and gas in the U.S.A. The figure was 418 at the end of 1946. The 1947 figures includes thirty-eight core-drilling crews.

There were 388 seismic parties and ninety-six gravity meter crews; seven magnetometer parties were operating.

A table gives by States the geophysical and core-drilling activity at the end of 1946 and 1947, according to type of crew. G. D. H.

999. Flying Magnetometer. H. Jensen. *World Petrol.*, Mar. 1948, **19** (3), 84.—See Abstract No. 856 (1948). G. D. H.

1000. Interpretation of Data from Electrical Resistivity Geophysical Surveys. J. M. Hough. *Nature*, 1948, **161** (4099), 812.—Electrical resistivity surveys are made by considering the changes in the resistivity, ρ, of the earth. For a homogeneous earth, $\rho = \frac{\pi a V}{I} \cdot \frac{(1-\alpha^2)}{2\alpha}$, where I is the current applied between two electrodes distant $2a$ apart, and V is the p.d. between two points on the earth's surface distant $2\alpha a$ apart. In other cases the relation between ρ and a is so complex and the number of parameters so large that interpretation of practical curves is difficult.

In the case of an earth composed of two parallel layers of homogeneous material an equation between ρ and a has been deduced. It can be solved by comparing the logarithmic plot of ρ and a for the experimental results with a series of theoretical curves obtained by plotting log ρ/ρ_1, against log a/h (h is the thickness of the upper layer of resistivity ρ_1) for different values of the reflexion factor. The displacement of the axes of the chosen theoretical curve from those of the experimental curve then gives h and ρ_1 directly. The theoretical curves can also be extended for use with multilayer earths subject to certain approximations being made.

The method has been used on four experimental curves, and in the one case when bore-hole data were available, the calculated and experimental results for the depth of the layer showed excellent agreement. H. C. E.

1001. Surveying in Brush-covered Country. K. H. Waters. *Oil Gas J.*, 29.4.48, **46** (52), 122.—The mesquite-covered country of parts of West Texas presents many surveying problems, especially in connexion with seismic work. The odograph permits the rapid placement of shot-point locations, the mapping of traces, fences, etc, and a skilled operator can maintain an accuracy of 100 ft in a 5-mile traverse. The shot-points and routes are flagged and then surveyed more accurately by means of truck-mounted towers kept 20 ft above the ground so that the line of sight is not obscured by brush. The shots are 3000–4000 ft, an accuracy of 1½ ft in 3000 ft being sought. The 40-ft stadia rod is set horizontally on top of the tower, and the angle it subtends at the observer is measured. The rod can be folded against the sides of the tower. G. D. H.

1002. Operating Problems of Marine Seismic Survey. R. A. Boulware and E. D. Alcock. *World Petrol.*, Mar. 1948, **19** (3), 60.—Marine-exploration costs are very high per unit of time, but if operational problems can be overcome, the cost per acre will be less than for land surveys. Weather cannot be eliminated. Full-time operation is possible by having about one and a half times the normal personnel, and at least two men capable of performing each one of the crew's tasks. Large seaworthy boats permit operation in rough seas. 85-ft converted naval craft have proved good recording boats, and deep-sea fishing craft of 60-ft or more are suitable to complete the boat complement. Radio communication and radar aid work in foggy weather. Radar and Shoran afford means of surveying, but are not perfect. They require highly skilled operators and will not operate continuously over long periods.

Shot-holes are not required. Seismometers are built into a cable round a strain wire, the whole being surrounded by a waterproof covering. The cable is preferably built in sections, each with one seismometer. The seismometers are gimbal-mounted. The cable is dragged on the sea-floor and thus must be robust. The charges are floated a few feet below the water surface, and cause little damage to marine life.

A marine seismic crew costs three to four times more per month than does a land crew, but output may be five to seven times more than for the normal land crew, provided the proper equipment, personnel, and techniques are employed.

G. D. H.

1003. Modern Seismic Refraction Techniques. S. Harris. *World Petrol.*, Mar. 1948, **19** (3), 72.—In modern refraction technique not only the first but also the second, third, and higher-order arrivals are observed. In the Edwards Plateau region of West Texas the hard surface limestone transmits considerable energy horizontally, and this disturbance interferes with the reception of clean seismic reflexions, but not with refraction records.

Refraction is also employed in caliche-covered areas. In West Texas the seismic refraction crew costs about $40,000/month. Dynamite charges range 5–1000 lb per shot. Surveying must be accurate to 25 ft in 25,000 ft. The refraction techniques may be fan shooting, broad-side continuous line shooting, and continuous inline shooting. In the first the seismometer spreads are along radii from the shot-points. In the second the seismometer spreads are on a line parallel with the shot-point line. The third method is one in which the shot-point is moved progressively along the line being followed, the seismometer spread being moved similarly. The computation technique is briefly described, and various diagrams are included. G. D. H.

Drilling.

1004. Operating Problems in Gulf Tidelands. K. M. Fagin. *Petrol. Engr*, Apr. 1948, **19** (7), 181.—Conditions and problems of drilling and operating on offshore leases are briefly described. The weather is probably the greatest operating problem, while the economics of drilling and operating are the great administrative difficulties.

C. G. W.

1005. Relation of Nozzle-fluid Velocity to Rate of Penetration with Drag-type Rotary Bits. J. D. Nolley, G. E. Cannon, and D. Ragland. *Oil Gas J.*, 6.6.48, **47** (1), 87.—In the course of drilling-technique development work it was noted that rate of drilling with drag-type bits was roughly proportional to rate of circulation. In consequence a survey was made on the circulating systems of Humble's drilling rigs to determine optimum conditions with available equipment. Conclusions drawn are: (1) drilling rate is directly proportional to nozzle-fluid velocity; (2) drilling rate is directly proportional to circulating rate; (3) maximum drilling rate is obtained with two-way drag bits when maximum weight just short of balling up is applied; (4) maximum drilling rate is obtained when all available mud-circulation horse-power is used so that the product rate of circulation × bit nozzle-fluid velocity is a maximum—rate of circulation so determined must be greater than the minimum for safe annular return velocity; (5) the use of drag-type bits with more than two blades, rotating speeds above 175 r.p.m., and the economies of extreme nozzle-fluid velocity should be investigated.

Results are calculated and plotted and simple charts for use with various drilling-rig assemblies given. C. G. W.

1006. Modern Rotary Drilling 52–56. J. Zaba. *Oil Gas J.*, 15.1.48, **46** (37), 95; 22.1.48, **46** (38), 105; 29.1.48, **46** (39), 303; 5.2.48, **47** (40), 87; 12.2.48, **46** (41), 105; 19.2.48, **46** (42), 131.—These papers conclude the series of various aspects of modern rotary drilling practices. Titles are; (51) Slush pump transmissions; (52) Hydraulic transmission for slush pumps; (53) Drilling bits; (54) Types of bits and penetration data; (55) Rotary-bit performance; (56) Bit weight and rotating speed. C. G. W.

1007. Portable Equipment for Shallow Drilling. A. L. Wait, Jr., and J. W. Hornbrook. *Petrol. Engr*, May 1948, **19** (8), 101.—A unit mounted on a four-wheel trailer with dual wheels, with a removable dolly at the front, is described. The unit will drill 2000 ft of 9-in hole. The mast is 54 ft and carries a three-sheave crown block assembly. Only three types of castings were employed: pillow blocks, bronze bearings, and cast steel sheaves. A spudder unit of all-welded construction is attached. Power is provided by two 100-h.p. engines, total weight is 26,000 lb. A skid-type unit capacity 1000 ft of 9-in hole, weight 10,000 lb, is also described. C. G. W.

1008. Assemblage Logs. K. A. Mygdal. *Petrol. Engr*, May 1948, **19** (8), 242.—With the comprehensive data now collected in drilling and completing wells, co-ordination of data has become an important and lengthy task. Information is conveniently accumulated on a geologist's sample log, but this is not easily reproduced or photostated. By plotting the log, together with all special data, caliper-electric logs sample information, etc, on 6-in wide tracing paper and keeping it up to date, progress prints may be made at any time. Sample logs are handled by using transparent overlay screens. Reproduction is effected by making a negative Van Dyke and then reproducing the Van Dyke as a blue-line print on a rotary printer. The scale of the logs is 1 in = 100 ft, and examples of the logs are illustrated. Applications are also mentioned. C. G. W.

1009. Tubular Goods Testing Device. L. S. McCaslin, Jr. *Oil Gas J.*, 6.6.48, **47** (1), 83.—This device determines the tensile strength of tubular goods, locates slag intrusions, laminations, and holes. It has been used to inspect core barrels, subs, back-off joints, and the drill pipe immediately above the drill collar, and accurately detects defective equipment. The apparatus to perform the test is set up in less than 20 min and one joint of drill pipe is tested within 10 min. The principle of the instrument is as follows. A ferromagnetic specimen inserted in a coil carrying a current, is magnetized by induction. The process of magnetization is effected by the formation of groups of elementary magnets. These groups form larger groups and so on through the entire structure. The length of each group varies with density and by measuring the group variation in physical properties can be followed. The presence of slag, seams, flaws, laps, or cracks breaks the magnetic groups, and this is indicated on graphs of length *vs.* intensity. C. G. W.

1010. Recovering Stuck Drill Pipe without Damage. H. David. *Oil Gas J.*, 6.5.48, **47** (1), 105.—The "back-off" method uses explosive to assist in unscrewing drill pipe. The depth at which pipe is stuck is determined and a ribbon-type shot ¾-in in diameter is run to the point at which it is desired to unscrew the pipe. The explosive core is approx. 5 ft longer than the joint length. The drill is then properly "weighed" so that it is neither in tension nor compression at the "back-off" point. Reverse torque is then held in the drill pipe and the shot detonated, permitting the pipe to be unscrewed. The shot may be run through fishing tools or other small-diameter drill pipe where no other tools can be run, and drill collars can be backed off and recovered, an operation impossible with cutters. Lengths of frozen drill pipe may be recovered by successive washing over and backing off. C. G. W.

1011. Drill Pipe Failures, Inspection, and Protection in Permian Basin. W. H. Crenshaw, V. B. Bottoms, C. N. Wallace, and C. R. O'Dell. *Petrol. Engr*, May 1948, **19** (8), 277.—Common causes of failure of drill pipes are: (1) abrasive wear; (2) fatigue failure; (3) mill defects; (4) handling defects; (5) internal defects; (6) box and pin defects. The occurrence and causes of such failures are briefly dealt with. Reduction in service failures has been effected by improved techniques, including: (1) use of drill collars; (2) use of salt string; (3) reduced speed of rotation; (4) use of smaller diameter pipes; (5) field inspection; (6) use of protection methods. These last two factors are dealt with at length. Inspection methods may be general, the magnetic-particle method or internal optical inspection used. Protection of drill pipe may be effected by: (*a*) use of chemical inhibitors; (*b*) shot peening the pipe; (*c*) using plastic coatings. These last two methods, or a combination of both, are economically sound and materially improve drill-pipe service. C. G. W.

1012. Interpretation of Electric Logs in Limestone. H. Guyod. *World Oil*, Mar. 1948, **127** (12), 90.—The interpretation of electric logs in sands and sandstones is relatively easy, but there are difficulties with limestones. The S.P. curve may be of little value in fractured or cavernous limestones, and in limestones with intergranular porosity the boundaries of different sectors may not be clearly defined. An increase in potential frequently indicates a tight formation. The resistivity graph in limestones is much distorted by tight zones, preventing the determination of the true resistivity, and hence the oil saturation. Special electrode arrangements may help in improving the resistivity log. G. D. H.

1013. Compounded Power Pumps Drill 10,000-ft Wells. H. L. Wilke and A. L. Harrington. *Oil Gas J.*, 6.5.48, **47** (1), 68.—Series operation of pumps has been effected and used in drilling two 10,000-ft wells. This has been made possible by using two large atmospheric air chambers augmented by fluid drives. The chambers are designed for a working pressure of 2500 p.s.i.; one is placed between low- and high-pressure pumps, and the other in the discharge line of the high-pressure pump. In operation it is only necessary for the low-pressure pump to be started first. A very even flow of mud was obtained and pressures as high as 2200 p.s.i. reached. Advantages gained are: (1) can divide total requirement between two or more pumps which are smaller and more easily transportable; (2) flexibility is obtained by paralleling at shallow depths (large volume, low pressure) and series operation at greater depths (small volume, high pressure); (3) minimum duty on valves and pistons due to division of pressure load; (4) more even distribution of load over the engines of the rig; (5) reduced frequency of liner changes. This method of coupling is the result of a research programme involving a mathematical study of pump performance, and a laboratory evaluation of this work. This preliminary work and field test are described. C. G. W.

1014. Diesel for Rotary Rigs in Deep Drilling. Anon. *World Petroleum*, 1948, **19** (4), 62.—General description of diesel drilling engines and their application is given. J. T.

1015. Portable Electric Rig Presents New Features. Anon. *World Petrol.*, 1948, **19** (4), 72.—A new portable drilling rig developed for Shell Oil Co. and costing $250,000 is described. Two slush pumps of 400 and 250 h.p., one double mud tank, one

chemical tank, three twelve-cylinder gas engines and their 200-KW D.C. generators, the change house, and the 500-h.p. draw-works motor are all mounted on wheels. The rotary table is driven by a 250-h.p. D.C. electric motor. Data on many new arrangements and some control instruments incorporated in the rig are given. J. T.

1016. Safe Practices in Using Wire Rope. D. Attaway. *Petrol. Engr*, May 1948, **19** (8), 254.—Principal factors in failure of wire ropes are: (1) incorrect size, construction, or grade; (2) sheaves of too small diameter, worn or narrow grooves, wrong alignment; (3) defective connexions or attachments.

Ends of wire rope should always be seized to prevent unlaying, and the ropes should always be kept lubricated, particularly when not in use. Inspections should be frequent and regular, and records should be kept. For general guidance: (1) a rope may be used till 65% of its original diameter for hoisting only with no broken wires; (2) replace if 10% of wires in one lag are broken or when adjacent broken wires in a strand exceed 20% of the wires; (3) if used for hoisting purposes should always be replaced when the thickness is one-half of the original diameter. C. G. W.

Production.

1017. Research Programme for Required Data. L. S. McCashlin, Jr. *Oil Gas J.*, 20.5.48, **47** (3), 205.—Problems about to be investigated in Carter's research laboratories, Tulsa, are: (1) why is oil where it is—reservoir rocks are being studied and analysed in an endeavour to form an acceptable theory of the origin and accumulation of oil; (2) best methods of finding oil—geophysical prospecting methods are being investigated and improved; (3) recovery of oil—research projects include: (*a*) reservoir behaviour and fluids in porous media; (*b*) secondary recovery problems; (*c*) cost reduction; (4) improving production and exploration equipment.

C. G. W.

1018. Method of Least Squares for Bottom-hole Pressure-gauge Calibration. M. F. Hawkins. *Petrol. Engr*, Apr. 1948, **19** (7), 93.—In handling data it is sometimes desirable to represent the data as an equation rather than graph. In such cases slopes, areas, etc., can be found by methods of calculus eliminating errors inherent in plotting data. Such a case is the bottom-hole pressure-gauge calibration. The method of least squares determines the equation of a line or curve that best represents experimental data, provided that the data can be represented by an equation of the form :—

$$Y = a + bx + cx^2 + dx^3 \ldots\ldots$$

The method actually evaluates the constants a, b, c, etc.

The application of the method to a bottom-hole pressure-gauge calibration is illustrated by an example. C. G. W.

1019. Extensive Testing Feature of Three Part Gas-injection Programme at West Edmond. L. S. McCashlin, Jr. *Oil Gas J.*, 29.4.48, **46** (52), 133.—A pilot-injection programme is planned to determine the feasibility of a whole field operation. To check on results, helium will be used as a tracer. 1% helium will be added for 1 week in each of the three pilot projects. An extensive testing programme will be carried out to determine the effect on reservoir behaviour and if serious channelling develops, profiling instruments will be used to determine gas flow in various zones.

C. G. W.

1020. Production and Disposition of Natural Gas by Californian Producers. E. K. Parks. *Petrol. Engr*, Apr. 1948, **19** (7), 58.—The development of conservation practices, restricting gas production and encouraging pressure maintenance, is reviewed. Pressure maintenance is adopted in order: (1) to keep oil thin and promote flow; (2) to reduce tendency to wet the reservoir rock; (3) to provide an expulsive force; (4) to prevent migration of oil into sands formerly occupied by gas; (5) to control encroachment of edge water; (6) to reduce production costs; and (7) to prevent condensation of gaseous products in the reservoir. The estimated increase in production with pressure maintenance is from 50% to 100% of production by natural deple-

tion. An example of a pressure-maintenance project is given. Uses of natural gas in the oil industry are described, being principally the production of natural gasoline, and as a fuel. Exploration and natural-gas reserves are also described.

C. G. W.

1021. Pressure Build-up Costs. Clean Out Costs. F. R. Cozzens. *Petrol. Engr*, Apr. 1948, **19** (7), 98.—Usual cleaning methods are confined to the shot-hole and leave sufficient sludge and paraffin immediately behind the sand face to reduce production. The principle of this method is to inject air or gas into a skeleton well pattern and cleaning out low producers after sufficient driving force has been built up in the sand. Input wells are best drilled, as a more efficient pattern is obtained than by adapting old wells. Very poor producers are salvaged of casing and plugged. When pressure has built up—six to eight weeks of gas injection—normal cleaning methods are adopted. It is claimed that the wells are cleaned better and stay clean longer giving substantial savings in costs of oil recovery.

C. G. W.

1022. Supports for Pumping Transmissions. J. Kulak. *Nafta*, Jan. 1948, **4**, 25–26.—Smaller but equally important items of equipment are likely to be forgotten and not improved at all. The Polish petroleum industry uses wooden posts sunk into the ground. These require daily lubrication and interruptions in pumping are due to breaking of transmissions by friction. Friction and poor lubrication cause losses in power. It is recommended that supports should be of metal, easily lubricated, exchangeable, and cheap. A diagram is given of a support as installed in Krościenko which satisfies these requirements. Additional advantage is offered by the fact that worn-out parts form iron and steel scrap.

M. S.

1023. Collection and Analysis of Data. B. F. Grant. *Producers' Monthly*, May 1948, **12** (7), 31.—Information on oil-well reconditioning was obtained from as many operators as possible. Data gathered included: (1) information on well and equipment; (2) information on the reconditioning job; and (3) production of the well. Information was obtained on 366 reconditioning jobs. Methods of correlating and analysing the data are described, and some data tabulated and plotted. Examples of the calculations of gained oil pay-out time and average price of oil during pay-out are shown, and the results of clean-out work and time required for the jobs to pay-out given.

C. G. W.

1024. Study of Medina Sand Production. W. P. Krausniek. *Producers' Monthly*, May 1948, **12** (7), 28.—This paper examines the relation of thickness and structural characteristics to productivity. The location, production characteristics, and geology of the field are described. It is concluded that variations in productivity cannot be accounted for by thickness relationships or structural characteristics. It is suggested that permeability and porosity conditions may be the influential factors.

C. G. W.

1025. Engineering Fundamentals Nos. 310–319. J. C. Calhoun. *Oil Gas J.*, 29..11.47, **46** (30), 91; 6.12.47, **46** (31), 121; 13.12.47, **46** (32), 123; 20.12.47, **46** (33), 91; 1.1.48, **46** (35), 71; 8.1.48, **46** (36), 83; 15.1.48, **46** (37), 93; 22.1.48, **46** (38), 107; 29.1.48, **46** (39), 307; 5.2.48, **46** (40), 91.—This series of short articles deals with the behaviour of fluids under reservoir conditions. Subjects dealt with are: (310) Estimation of solution gas; (311) Estimation of formation volume factor; (312) Compressibility of reservoir fluid above the bubble-point; (313) Production by expansion of reservoir fluid above the bubble-point; (314) Permeability; (315) D'Arcy's law and radial flow; (316) Résumé of equation and D'Arcy's law; (317) Effective Permeability; (318) and (319) Combination of Permeabilities.

C. G. W.

1026. Engineering Fundamentals Nos. 320–329. J. C. Calhoun. *Oil Gas J.*, 12.2.48, **46** (41), 107; 19.2.48, **46** (42), 135; 26.2.48, **46** (43), 149; 4.3.48, **46** (44), 99; 11.3.48, **46** (45), 117; 18.3.48, **46** (46), 137; 25.3.48, **46** (47), 205; 8.4.48, **46** (49), 99; 22.4.48, **46** (51), 119; 6.5.48, **47** (1), 113.—Subjects discussed are: (320) Relative Permeability Ratio; (321) Effect of Connate Water; (322) Relative Permeability; (323) Reservoir forces—controlling factors; (324) Reservoir Energies; (325) Capillary Forces; (326)

Wettability; (327) and (328) Capillary Pressure; (329) Use of Capillary Pressure curves. C. G. W.

1027. Secondary Recovery of Crude Oil in Germany. W. Ruhl. *Producers' Monthly*, May 1948, **12** (7), 16.—The development of the oil industry in Germany is reviewed. Most oil deposits in Germany are connected with the salt domes of the Zechstein and have been subjected to numerous tectonic disturbances, fractures, etc. Consequently the deposits have low gas content and low reservoir energy. Application of secondary recovery methods was encouraged by the small recovery factors of primary methods and the fact that unrestricted unit exploitation was possible. The tectonic division of all fields into small blocks, however, minimized the possibilities of success. Secondary recovery methods used are oil mining after depletion, repressuring, and water-flooding. Application of these methods in various fields is described. Methods under consideration are the application of chemicals and of heat.
C. G. W.

1028. Practical Problems for Secondary Recovery Research. R. V. Hughes. *Producers' Monthly*, May 1948, **12** (7), 21.—Present secondary recovery methods leave up to one-third of the original oil as economically irrecoverable. Information which would improve recovery and recovery methods includes: (1) how to obtain reliable cores. Flushing of the sands ahead of the bit is one major problem in coring; (2) improving core analysis methods and interpretations. The tendency has been towards fundamental investigations which are of little use in planning a recovery project; (3) interpretation of electric logs; (4) response to water-flooding or gas drive before development; (5) how to predict proper well-spacing patterns and injection pressures; (6) how to improve well-completion practices; (7) how to improve input waters; (8) best substitute for natural gas in gas-drive operations; (9) how to detect and correct bypassing and channelling; (10) how to recover economically oil left behind by present methods; (11) how to predict the economics of a secondary recovery operation.
Each of these problems is discussed and some solutions suggested. C. G. W.

Oilfield Development.

1029. Airplanes for Moving Equipment and Personnel. C. Hart. *Oil Gas J.*, 20.5.48, **47** (3), 190.—The value of airplanes for supervision transport of personnel and equipment, surveying, and pipe line patrolling is briefly discussed. The costs of running an airplane are listed. C. G. W.

1030. 3,000,000,000 brl net Added to World Crude Reserves. Anon. *World Oil*, Feb. 1948, **127** (11), 271.—At the end of 1947 proved world crude reserves were 61,913,652,000 brl, about 3,200,000,000 brl more than at the beginning of the year. The figures do not include some probable reserves in the Middle East and elsewhere, and 3,500,000,000 brl of condensate and natural-gas liquids known in the U.S.A. The U.S. crude reserves are 21,718,302,000 brl. The ratio of the U.S. reserves to 1947 production was 11·7. The Mexican reserves are estimated at 1,058,000,000 brl, and in Venezuela the figure is 8,350,000,000 brl. The Iran reserves are placed at 5,625,000,000 brl. Saudi Arabia's proved reserve is 3,600,000,000 brl.
A table gives the reserves by countries, together with the 1947 production, and the ratio of the two figures. G. D. H.

1031. 1948 to Bring Another Sharp Gain in World Crude Production. Anon. *World Oil*, Feb. 1948, **127** (11), 245.—2,986,257,000 brl of crude was produced in 1947, 136,000,000 brl more than in 1946, and 50% above the 1938 figure. The Middle East gave 823,317 b.d. in 1947. Venezuela produced 1,192,427 b.d. in 1947, and Russia's daily output is estimated to have been 471,233 b.d.
Tables give the annual and daily outputs by countries for 1938, 1946, and 1947, together with the cumulative production to the beginning of 1948, and the annual outputs since 1857. G. D. H.

1032. 34,811 New U.S. Wells in 1948 is Drilling Forecast. R. L. Dudley and E. Sterrett. *World Oil*, Feb. 1948, **127** (11), 109.—It is expected that 34,811 wells will be drilled in the U.S.A. in 1948, and 6014 will be exploratory wells. Texas may drill

10,676 wells. Drilling is expected to be less in 1948 than in 1947 in ten areas. Some indication of the equipment position is given.

A table shows by States and districts the 1947 completions and 1948 forecast both for total wells and exploratory wells. G. D. H.

1033. Well Completions and Footage. Anon. *World Oil*, Feb. 1948, **127** (11), 114.—33,646 wells of all kinds were completed in the U.S.A. in 1947, the figure being 2801 greater than in 1946. The record figure was 35,213 in 1937. The total footage of new wells in 1947 was 112,748,844 ft, making the average depth 3417 ft compared with a peak average of 3489 ft in 1945.

The 1947 figure comprises 1799 input wells, 317 gas-input wells, forty-six salt-water disposal wells, and 651 wells drilled deeper; the rest sought oil or gas. 17,478 found oil, 283 distillate, and 3526 gas. Three-quarters of the completions were in California, Illinois, Kansas, Louisiana, Oklahoma, Pennsylvania, and Texas; over one-third of the wells were in Texas.

Tables show the number of new wells and their footage yearly from 1925; the types of completions yearly from 1918; and the types, depths, and numbers of wells completed by States and districts in 1947. G. D. H.

1034. Drilling Depth Mark May Fall Again in 1948. Anon. *World Oil*, Feb. 1948, **127** (11), 120.—The drilling depth record is now 17,823 ft, and was made in Caddo County, Oklahoma. 16,000-ft wells have been drilled in Oklahoma, California, and Texas, and nineteen States have had 10,000-ft wells.

A table lists the depth-record-holding wells in the U.S. since 1927, and a further table gives the drilling-depth records by States and districts. G. D. H.

1035. U.S. Crude Production Certain to Hit Another All-time Peak. Anon. *World Oil*, Feb. 1948, **127** (11), 164.—The U.S.A. oil output was 1,853,166,000 brl in 1947, compared with 1,733,424,000 brl in 1946. The December 1947 rate was 5,274,100 b.d. compared with 5,077,100 b.d. for the year. It is estimated that the 1948 average will be 5,325,000 b.d.

Texas, California, Louisiana, Oklahoma, and Kansas are the five leading States and provide 84% of the U.S. production; Texas gave 44% of the total, and West Texas showed a marked rise in 1947.

Tables give the U.S. outputs by years from 1918, the 1941, 1946, and 1947 outputs, together with the December figures for these years and the cumulative totals by States; and the annual production by States from 1859. G. D. H.

1036. 1,000,000,000 brl Added to Nation's Petroleum Reserves. Anon. *World Oil*' Feb. 1948, **127** (11), 177.—The U.S.A. reserves of crude and condensate were 23,066,576,000 brl at the end of 1947. During the year the discoveries amounted to 2,995,388,000 brl, and the production was 1,853,166,000 brl. Crude reserves alone are placed at 21,718,302,000 brl, having risen by 844,742,000 brl in 1947. Texas has 12,271,213,000 brl of the crude reserves.

Tables show the estimated proved reserves by States and districts for the beginning and end of 1947, together with the 1947 production. The country's reserve and production figures, together with the new reserves discovered yearly and the ratio of reserves to production are given annually from 1918. A further table shows accumulated discoveries, cumulative production, and remaining reserves since 1918.

G. D. H.

1037. Producing Depth Records Broken Twice in 1947. Anon. *World Oil*, Feb. 1948, **127** (11), 180.—The deepest production is at 13,904 ft in the Queen Bess Island field of South Louisiana. Four States now have production below 13,000 ft—Louisiana, California, Mississippi, and Wyoming. Eight States have production below 10,000 ft.

The U.S. producing depth records are listed from 1927, and they are also given by States and districts for the present. G. D. H.

1038. Record Daily Output Reached by U.S. Producing Oil Wells. Anon. *World Oil*, Feb. 1948, **127** (11), 185.—At the end of 1947 the U.S.A. had 428,522 producing oil wells, 17,478 new oil wells having been completed during the year and 13,257 having

been abandoned or shut in. The average output per well was 11·9 b.d., and it was 12·3 b.d. at the end of the year. 49,399 wells were flowing at the end of the year. 37,070 flowing wells were in Texas. Of the States with more than 500 wells, Mississippi had the highest daily average (105·6 brl). 145,675 of the oil wells are in the Appalachian States, and these average less than 1 b.d. per well.

Tables give the numbers of producing oil wells, the number of new oil wells, and the daily average production yearly from 1918; also by States, the numbers of flowing wells and those on artificial lift, together with the overall daily average outputs for 1946 and 1947. G. D. H.

1039. Cross-roads, New Mexico Discovery. K. B. Barnes. *Oil Gas J.*, 20.5.48, **47** (3), 214.—This well, produced from 12,115 ft to 12,215 ft, flowed 3775 b.d. through a ½-in tubing choke. The oil was 42·6° gravity. Drilling and completion data are presented, and the well history described. C. G. W.

1040. San Juan Basin Production, Exploration, Literature. R. L. Bates. *World Oil*, Mar. 1948, **127** (12), 116.—Tables give the production of oil and gas by fields, the producing formations, types of oil, and the wildcats drilled and their findings. The bibliography lists important papers, giving brief notes on each paper. G. D. H.

1041. Thirty-three Mexican Rigs Running as New Year Began. Anon. *World Oil*, Mar. 1948, **127** (12), 238.—A table lists the wells completed in Mexico in 1947, giving the location, depth, and result. Twenty-three produced oil, two gas, and twenty-five were dry. G. D. H.

1042. Mexico Achieves Greater Oil Output in 1947; Further Increase Seen this Year. W. W. Burns. *Oil Gas J.*, 13.5.48, **47** (2), 200.—Mexico produced 56,110,515 brl of oil in 1947; the 1946 figure was 49,239,800 brl. Twenty-four producers and six dry holes were drilled in proved areas, and twenty-two wildcat wells were completed, three being productive.

57% of the 1947 output was from Poza Rica, 18% from the Tampico area, 14% from the Golden Lane, and 11% from the Isthmus of Tehuantepec.

Currently reserves are estimated as Poza Rica 932,000,000 brl, Tampico 90,000,000 brl, and the Southern Zone 36,000,000 brl.

A table gives the 1947 production of oil and gas, the cumulative production, oil gravity, number of wells, producing formation and depth, proved area, and year of discovery for each field. G. D. H.

1043. International Developments. Anon. *Oil Gas J.*, 26.2.48, **46**, (43), 92.—Early in February it was estimated that 1076 rotary rigs were operating in forty-three countries outside the U.S.A. 500 of these rigs were in Russia, 139 in Venezuela, sixty in Roumania, and fifty-four in Argentina. A table gives the distribution.

Oil reserves in the Caribbean area are estimated to be 9,200,000,000 brl, and in the Middle East 28,000,000,000 brl. In 1947 Venezuela's output averaged 1,190,000 b.d., bringing the country's cumulative production to 434,500,000 brl, of which 305,900,000 brl has come from Western Venezuela. 787 wells were completed in Venezuela in 1947, and 694 were oil wells. Nine new fields were discovered in 1947, two in the Maracaibo basin, two in Guarico, and five in Anzoategui. Good Cretaceous production has been found at La Paz and Mara.

Colombia produced 26,023,738 brl in 1947. 133 exploitation wells were completed, and 126 produced oil. Eighteen exploration wells were drilled and two found gas.

Argentina produced 21,535,000 brl in 1947, 41·7% coming from Comodoro Rivadavia.

Six wells were completed in Bolivia in 1947. A new field is said to have been discovered 24 km south of Camiri.

The Dom Joao field was opened in Brazil in 1947. Four small producers have been drilled to shallow sands.

1 La Paz in Paraguay was drilling at 5866 ft at the end of the year, in black shale, probably of Devonian age. No significant oil shows have been found. G. D. H.

1044. Oil Mining in Europe. A. E. Gunther. *Petrol. Engr*, May 1948, **19** (8), 74.—In 1765 the Pechelbronn oil-mining galleries were said to be 1500 ft long, and pits

were sunk to a depth of 160 ft, but systematic oil mining is a twentieth century development. Well depletion at Pechelbronn removes about a sixth of the oil; mining drainage extracts a third. At Wietze the oil sand was removed and the oil extracted by steaming. At Pechelbronn the method ultimately employed involved tunnelling in the beds above the oil sand and the sinking of pits into the sand, because of the hardness of the sand.

Pechelbronn has a series of fault blocks which are slightly tilted. The oil is mainly in Oligocene sands, but also in the Eocene, Dogger, and Lower Keuper. The sands are lenticular and 0·3–0·5 m thick. In mid-1940 the Pechelbronn mines had 300 km of galleries. Production from the mines began in 1917, and by autumn 1944 had reached 5,380,000 brl, production from wells then being 13,350,000 brl. In the ten-year period before the war Pechelbronn's output averaged 530,000 brl/year, of which 40–45% came from the mines.

Wietze has produced 1,672,026 tons of oil from wells, and 590,646 tons by mining, and currently the output is 3000 tons/month, of which about 2000 tons is obtained by mining. Wietze is on the west-northwest plunging nose of the Steinforde–Wietze salt mass. It is complicated by thrusting, faulting, and unconformities. Oil occurs in sands and sandstones in the Rhaetic, Cornbrash, Wealden, and Upper Cretaceous. Mining is confined to the Rhaetic and Wealden on the northeast flank. The Wealden sands are treated by removal. They contain about 25% of oil by volume and are washed. The Rhaetic is exploited by galleries in and adjacent to the sands. The cost per ton of oil in 1944 at Wietze is estimated at 60 Reich marks for the indirect mining method, and 120 Reich marks for the direct (excavation and washing) method.

G. D. H.

1045. [Polish] Production of Crude, Natural Gas, and Gasoline in 1947. Anon. *Nafta*, Jan. 1948, **4**, 37 (Report Section).—Figures for 1947 are compared with those for 1946 (11% increase) and with target figures (101·2% reached) for crude. Same items for gasoline show 247% compared with 1946, natural gas 105·8% compared with target for 1947. Consumption of crude fell by 14%. New wells were added to the existing grid in December. M. S.

1046. A.I.M.E. Gets World Oil Reports. W. W. Burns. *Oil Gas J.*, 19.2.48, **46** (42), 73.—Saudi Arabia produced 89,851,645 brl of oil in 1947, the bulk coming from Abqaiq and Damman; Iran's 1947 output is estimated to have been 154,360,000 brl. Kuwait produced 16,227,093 brl of crude in 1947. The oil at Burgan is obtained from three main Middle Cretaceous sands.

In 1947 Egypt produced 9,316,515 brl, of which 8,847,193 brl came from Ras Gharib. Sudr has five oil wells with potentials of 400–3500 b.d., producing from basal Miocene and Upper Eocene sandstones and limestones at depths of 2650–3000 ft.

Kirkuk gave 35,040,000 brl of oil in 1947, production being limited to 90,000 b.d. from ten wells on the Baba dome. During 1947 geophysical work was carried out on the Trucial coast, and two wildcats were spudded in Syria. The Terbol well was under way in Lebanon and 1 Huleigat in Palestine. G. D. H.

Transport and Storage.

1047. Pipeline Activity at All-time Peak; World Programme Totals 38,000 miles. P. Reed. *Oil Gas J.*, 20.5.48, **47** (3), 169.—Six tables show domestic (U.S.A.) and foreign major crude-oil, large products, and natural-gas lines projected; giving mileage, diameter, status, location, and contractor. Large diameter pipe of increasingly larger dimensions is being employed for trunk lines for both crude oil and natural gas.

G. A. C.

1048. Expansion of Great Lakes Pipeline. Anon. *Petrol. Engr*, Apr. 1948, **19** (7), 51.—Expansion and modernization of this system entailing construction of 1200 miles of lines, fourteen pump stations, eight delivery terminals, and remodelling of existing stations increased the capacity by 50%.

The pipeline system, station design, and tank farm loading and delivery system are described. C. G. W.

1049. New Products Pipeline from Gulf Coast. F. H. Love. *Petrol. Engr*, May 1948, **19** (8), 188.—Difficulties encountered in constructing a 16-in line from Sinclair's Refinery at Houston to Arlington, Texas, are described. C. G. W.

1050. Locating Pipelines and Leaks by Electronics. J. L. Cassingham. *Petrol. Engr*, Apr. 1948, **19** (7), 78.—Damage to pipelines when laying new lines can be avoided by using a pipe locator. Lost pipelines, etc, can also be traced by this method. The instrument consists of a transmitting and receiving unit. Distortion of the field, created by the transmission unit, by a conductor produces a signal in the receiving unit. Location and depth of a pipe can be found in this way.

The leak detector is devised to amplify the vibrations set up by a fluid escaping under pressure. The point of greatest intensity gives the location of the leak. Applications and limitations of the methods are mentioned. C. G. W.

1051. Electric Power for Gas Transmission. W. H. Struve. *Petrol. Engr*, May 1948, **19** (8), 59.—The principal reasons for not adopting electric power in early days were: (1) costs too high; (2) insufficient power, extension too costly, service continuity not good enough; (3) initial investment too high; (4) very high capacity factors desired; (5) not sufficient flexibility in the constant-speed electric motor. These factors are discussed, and it is concluded that electrically powered centrifugal compressors are economically feasible when capacity factors and power usage are properly considered. Sufficient flexibility is claimed for a multi-unit single-stage centrifugal compressor driven by a constant-speed induction motor. C. G. W.

1052. Storage of Natural Gas in Underground Pipe Sections. D. V. Meiller. *J. Western Soc. Engrs*, Mar. 1948, **53** (1), 19.—In order to meet peak demands, gas storage capacity is necessary. Available methods are: (1) conventional low-pressure gas holders; (2) conventional high-pressure above-ground gas holders pressures 60–100 p.s.i.; (3) storage of natural gas in the liquid state at low temperatures and normal pressures; (4) natural gas absorbed in propane, either at low temperatures and normal pressures or normal temperatures and high pressures; (5) other methods such as absorption or a hydrate form; (6) stored at high pressures in buried pipe. Requirements for a storage scheme are: (1) it should be safe and reliable; (2) subject to quick installation; (3) reasonable investment and operating costs; (4) fairly simple in design and operation.

It was decided that storage in buried pipe at high pressures was the best method. The storage plant consists of approximately 40-ft lengths of 24-in B.D. seamless high-carbon alloy steel pipe. These sections are swedged down and tapped for 1¼-in pipe thread to avoid the necessity of welding. The gas is stored at 2240 p.s.i., at which pressure approximately 43% more than theoretical can be stored. A 40 million cu. ft plant was completed within six months of start of combination at a cost of approximately $55.00 per 1000 cu. ft.

Steel used was A.P.I. 1780, and each section has a capacity of about 25,000 cu. ft at 2240 p.s.i. Sections are joined by adaptors and expansion joints. Each unit of storage is made up of 40 sections a capacity of 1 million cu. ft. Pipes are protected by a coating of Bitumastic wrapped with asbestos felt. In addition cathodic protection is provided. After coating and wrapping the pipe is tested for defects with a Holiday detector.

To prevent freezing of regulators and contraction of mains in expanding the gas from storage pressure to distribution pressure the gas is heated by heat exchangers using low-pressure steam. About 75 to 80 million cu. ft can be stored by this method on an area of 160 acres. C. G. W.

1053. Progress in Metals. W. L. Nelson. *Oil Gas J.*, 20.5.48, **47** (3), 237.—The resistance of grey and austenitic cast iron to several petroleum services is tabulated. The table shows corrosive medium, location of test specimens, duration of test, temperature, aeration, and velocity. G. A. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1054. Models for Refinery Design. G. I. McBinde. *Petrol. Engr*, Mar. 1948, **19** (6), 94.—The author discusses the progress of a refinery design with and without a scale model and points out the advantages of the use of the model. These are: (1) ease in the location of vessels and piping; (2) the operator has the chance to suggest changes before the design has developed too far; (3) the design can be considered on its own merits and not with reference to previous units of a similar character. G. K. A.

1055. Liquid Distribution Characteristics of Tower Packing Materials. W. A. Cairns. *Canad. Chem. & Process Ind.*, 1948, **32**, 314–317.—Experiments were carried out to determine the degree and uniformity of distribution of liquid flowing down a packed tower. The tower was 44 in in dia and 24 in high; the liquid was water, and there was no upward flow of gas. The packings were pebbles, broken quartz, Raschig rings, Berl saddles, single spirals, and triple spirals. In all cases the degree of distribution was surprisingly low and the uniformity poor. In general, the larger the packing size, the wider but less uniform was the distribution. A. C.

1056. Process Engineers' Guide to the Centrifugal Compressor—IV. I. Karassik. *Chem. Engng*, 1948, **55**, 118–121.—The calculation of compressor capacity, h.p. requirements, and temperature rise are dealt with. The losses that occur in actual compressors can be taken into account by assuming that polytropic rather than adiabatic compression takes place, the polytropic efficiency being a function of the polytropic exponent. Expressions are derived for the total fluid head, the fluid efficiency of the compressor, capacity corrections for temperature and pressure variation, and temperature rise. Numerous examples are given. R. T. W. H.

1057. Maintenance of Cooling Towers. J. G. De Flon. *Pipe Line News*, May 1948, **20** (5), 14.—See Abstract No. 742 (1948).

1058. Heat Transfer Symposium. Anon. *Chem. Engng*, 1948, **55**, 134.—A brief survey is given of the Oak Ridge Symposium on Heat Transfer (Dec. 8–13, 1947). The twenty-eight presentations covered conduction, convection, radiation, boiling, condensation, mathematic and analog methods, and materials of construction.
R. T. W. H.

1059. Predicting Commercial Heat-Transfer Coefficients. E. P. Breidenbach and H. E. O'Connell. *Trans. Amer. Inst. Chem. Engrs*, 1946, **42**, 761–776.—Eighty overall heat-transfer coefficients obtained on twenty-four heat exchangers are compared with theoretical coefficients predicted from correlations available in the literature. While adequate agreement was obtained in this manner on partial condensers, total condensers, liquid–liquid exchangers, and gas exchangers for materials having the same fouling characteristics as water, chlorinated hydrocarbons, and slow-boiling hydrocarbons, that for reboilers cannot be calculated as the boiling or fouling film cannot be determined. For other systems, the coefficient can be calculated if the boiling factor is known. Systems having a high fouling factor tend to produce less accurate results. J. G. H.

1060. Simplified Approach to Mixing Problems. H. E. Serner. *Chem. Engng*, 1948, **55**, 127.—The treatment is confined to liquid, and liquid–solid mixing problems. A simplified approach to the problem is adopted, omitting the less-important variable factors. The power required to produce and maintain continuous agitation is dependent on the amount of initial acceleration required, the energy loss caused by surface friction, and the physical characteristics of the material.

Equations are developed for the time required to bring the tank contents up to full velocity, and for the h.p. requirements with varying physical properties of the liquid being mixed. Graphs correlating peripheral velocities with unit power requirements and agitator velocities, for varying liquid viscosities, are presented, and examples

of calculations for power requirements and time requirements (to attain the desired peripheral velocity) are given with clarity.

The effect of the presence of coils in a tank, and the total mixing time in relation to the time required to bring the mixture to its final velocity are briefly discussed, together with liquid–solid mixing. R. T. W. H.

1061. Intermediate Alloy Steels at Elevated Temperatures. R. F. Miller. *Petrol. Engr*, Jan. 1948, **19** (4), 178.—Creep strength and corrosion resistance are of prime importance in installations requiring steels for service at high temperatures and pressures. Factors influencing the creep and rupture characteristics are primarily the presence of effective alloys and the microstructure induced by suitable heat treatment.

Ten tables list the steels most commonly used in petroleum refining, together with their properties at elevated temperatures. The tensile-strength, creep-strength, and rupture-strength curves show the effect of various alloys. G. K. A.

1062. New Process to Make Specialized Alloy Steels. Anon. *Petrol. Engr*, Feb. 1948, **19** (5), 92.—The process, developed by the M. W. Kellogg Co., is an electric-ingot method for continuous metal casting. Alloying elements are continuously fed at a controlled rate into an electrical apparatus from which air is excluded and in which an ingot of any desired analysis is produced by progressive solidification.

Advantages claimed are: (1) uniformity; (2) quality; (3) ductility; (4) cost; (5) flexibility of the process; (6) suitability for high-temperature alloys. G. K. A.

1063. Short-cut Estimation of Welded Process Vessels. H. How. *Chem. Engng*, 1948, **55**, 122–126.—A series of twenty-two figures is presented, covering the cost of cutting, plate rolling, edge preparation, welding rod, welding labour, and flux, for a variety of materials, including ordinary carbon steels, chrome steels, chrome–nickel and stainless steels and Everdur. The fabrication costs of various types of nozzles and the machining costs of plate flanges are included. The graphs enable a rough estimate of the cost of fabrication to be made. R. T. W. H.

Distillation.

1064. Simplified Multi-Component Fractionation Calculations. R. V. Bailey and J. Coates. *Refiner*, Mar. 1948, **27**, 126.—This is the final part of a series of articles dealing with calculation procedures applicable to multi-component fractionation. In this article a graphical solution for tray requirements is presented; the method involves pseudo operating lines and equilibrium curve defined so as to permit application at reflux ratios near the minimum as well as at larger reflux ratios. The pseudo operating lines and the equilibrium curve are determined by a calculation of the compositions on the feed tray and the tray above. The maximum error is 5%, and the calculations involved are said to be less than any other method giving results of comparable accuracy. The method is especially advantageous for cases when the feed tray concentrations and temperature are required for a heat balance round the feed point. H. A. C.

1065. Hydrocarbon Absorption and Fractionation Process Design Methods. 9. Proposed Absorption–Stripping Calculation Method. W. C. Edmister. *Petrol. Engr*, Jan. 1948, **19** (4), 68.—A résumé of the Edmister absorption and stripping calculation method developed in the previous paper is given. The method employs effective absorption and stripping factors which are algebraic and graphical functions of terminal conditions, with absorption and stripping efficiency equations that allow for the presence of solute in the lean oil, the equations being based on: (1) the equilibrium between liquid and gas at each theoretical stage; (2) effective absorption and stripping factors.

Two examples are worked out to illustrate the method and in one of these a comparison is made between the Horton–Franklin and the Edmister methods.

G. K. A.

1066. Hydrocarbon Absorption and Fractionation Process Design Methods. Pt. 10. Fractionation Fundamentals—Two Component Systems. W. C. Edmister. *Petrol. Engr*, Feb. 1948, **19** (5), 76.—This is the first instalment of several on fractionation. The basic concepts of fractionation are considered and the fundamentals are covered by considering a binary system. The graphical method of McCabe–Thiele is considered in detail while analytical methods of Lewis and Smohr are briefly outlined.

The ultimate aim of the author in this series is to consider the fractionation of multi-component systems. G. K. A.

1067. Hydrocarbon Absorption and Fractionation Process Design Methods. Pt. 11. Binary Distillation Calculations. W. C. Edmister. *Petrol. Engr*, Mar. 1948, **19** (6), 57.—Two-component fractional distillation calculations may be made by analytical or graphical methods. To illustrate the calculations the fractionation of an ethane-propane system is worked out using: (1) the McCabe–Thiele graphical method, for problems assuming constant overflow; (2) the Ponchon–Savarit graphical method from the enthalpy-composition diagram for a given pressure, this method being worth while when constant overflow cannot be assumed; (3) an analytical plate-by-plate method by combining material balances with equilibrium dew-point determinations for each plate. G. K. A.

1068. Control of Narrow Range Fractionation Columns. G. G. Gallagher. *Petrol. Engr*, Mar. 1948, **19** (6), 82.—In the fractionation of *n* and *iso*butane at 110 p.s.i. column pressure, 1° F change in column temperature causes a change in product composition of 4% while a change of 1 p.s.i. will cause a change in product composition by 2–3%, hence the need of accurate control of temperature and pressure. The article describes a vapour-pressure balance suitable for the fractionation of binary mixtures. This is a composition controller, the principle of which is the balancing of the pressure at a given point in the column against the vapour pressure of a sample of mixture of the required composition at the same temperature as exists in the column. Using this controller a change of p.s.i. column pressure will only change the product composition by 0·4%. The instrument has not been developed for multi-component mixtures. G. K. A.

1069. Design and Operation of a Light Hydrocarbon Distillation Drier. G. C. Gester. *Chem. Eng. Progr.*, Mar. 1947, **43** (3), 117–122.—Design and operating data for distillation equipment which reduces the water content of a hexane cut from 130 to less than 20 p.p.m. is described. The connexion between vapour–liquid equilibria and plate efficiencies is discussed, the limitations of distillation drying are enumerated, and results are compared with those obtained with chemical driers. J. G. H.

Absorption and Adsorption.

1070. Projected Natural-Gas Processing Units Rated at Billion-Foot Daily Capacity. Anon. *Oil Gas J.*, 20.5.48, **47** (3), 181.—A list shows that thirty operating companies are planning, building, or have authorized construction of fifty-seven different projects, including new gasoline and cycling plants, a new gas-injection unit, and a number of plant expansions.

Company, location, type of project, capacity rating, status, completion date, and contractor are shown. G. A. C.

Cracking.

1071. T.C.C. Processing of Pennsylvania Oil Fractions. H. D. Noll and D. M. Luntz. *Petrol. Engr*, Jan. 1948, **19** (4), 162.—In view of the low octane number of Pennsylvanian thermally cracked gasoline a comparison is made to show the advantages of the T.C.C. process. These are: (1) the production of gasoline of considerably higher C.F.R.–R. and C.F.R.–M. octane numbers; (2) a greater yield and better solubility. Economic factors are not considered. G. K. A.

1072. First Turnaround of Leonard T.C.C. Unit. J. S. Pfarr. *Petrol. Engr*, Feb. 1948, **19** (5), 51.—The first turnaround of the Leonard T.C.C. unit in 4557 man-hours after an initial run of 222 days is described. Only forty men were used in two crews

of twenty each. The charge to the unit had been reduced crudes of 0·9% sulphur content, hence some corrosion was anticipated. The largest items of repair were the renewal of sections of the transfer lines between the heaters and tar separator, the removal of the hot tar lines from the bottom of the tar separator and the cleaning and adjustment of the wet-gas compressors.

The T.C.C. kiln and reactor showed no corrosion in spite of the high sulphur content of the charge and of the 4557 hr impeded 2954 hr were taken up in the inspection and maintenance of conventional items of refinery equipment.

Tables are given showing the requirement in man-hours for each job item.

G. K. A.

Polymerization.

1073. Polymerization of Pentenes. V. N. Ipatieff and R. E. Schaad. *Industr. Engng Chem.*, 1948, **40**, 78.—A mixture of 2-methyl-2-butene and 2-methyl-1-butene was catalytically polymerized in the presence of 3-methyl-1-butene at 80° C and 100° C, using solid phosphoric acid as catalyst. The decenes thus produced were subjected to catalytic hydrogenation, yielding decane fractions with 94·6 Octane Number (motor method).

It was noted that during polymerization of the 3-methyl-1-butene, 8% of it isomerized to mainly 2-methyl-2-butene. J. D. T.

1074. Thermal Depolymerization of Viscous *iso*Butylene Polymer. J. A. Reid and G. C. Bailey. *Industr. Engng Chem.*, 1948, **40**, 349.—Thermal depolymerization of *iso*butylene polymer at various pressures gave products in the viscosity range of lub oils. Mild depolymerization yielded mono-olefins, whilst under more severe conditions, the more volatile products were more saturated than pure mono-olefins.

J. D. T.

Chemical and Physical Refining.

1075. Modern Trends in Oil Refining. F. J. Dunstan. *Mech. World*, 27.5.48, **123**, 609.—An increased knowledge of the components of petroleum has led to improved methods of refining to manufacture products for specific uses. The primary operation of distillation has been developed so that much closer fractionation can be obtained, and pretreatment to remove sulphur compounds has obviated many corrosion difficulties at refineries. The processes of cracking and reforming have allowed the production of much higher quality gasoline, whilst solvent extraction methods produce high-grade lubricants from crudes which hitherto were thought to be unsuitable raw materials, though the use of such solvents as sulphur dioxide has introduced new corrosion problems which have had to be solved. These new processes have increased the number of by-products from the petroleum industry which, in turn, have assisted in the development of the petroleum chemical industry. O. M.

1076. Catalytic Desulphurization of High-Sulphur Stocks by the Cobalt Molybdate Process. C. Berg, W. E. Bradley, R. I. Stirton, R. G. Fairfield, C. B. Leffert, and J. H. Ballard. *Chem. Eng. Progr.*, Jan. 1947, **43** (1), 1–12.—The cobalt–molybdate desulphurization process permits the refining of crude oil containing 5% or more of sulphur to produce a marketable motor fuel with a sulphur content of less than 0·1% for light distillates to 0·5% for heavy distillates. Fundamental basis of the process is the conversion of organically combined sulphur to hydrogen sulphide by contact with cobalt–molybdate catalysts in the presence of hydrogen. Pilot-plant operation with three types of feed stock is described, and the effect of variations in temperature and pressure of reaction, hydrogen sulphide content in the recycling gas, space velocity, and hydrogen recycle rate are evaluated. J. G. H.

1077. Socony-Vacuum Uses "Time Towers" in Gasoline Treating. R. B. Tuttle. *Oil Gas J.*, 3.6.48, **47** (5), 87.—A simple effective method for controlling the added-sulphur content of doctor-treated gasoline is described. A continuous treating system is employed, controlled by operator adjustment to the sulphur–oil stream as indicated by simple stream test at three points in the process.

The system employs delayed contact or "time towers" and conventional mixers. Caustic pre-wash solution averages 15° Be. The gasoline is sweetened progressively. A flow sheet illustrates the article. G. A. C.

Special Processes.

1078. Tonnage Oxygen. C. R. Downs and J. H. Rushton. *Chem. Eng. Progr.*, Jan. 1947, **43** (1), 12–20.—Oxygen of 97% or less purity is produced cheaply by air liquefaction and rectification. Applications are discussed, including synthesis gas production. J. G. H.

1079. Liquid and Solid Hydrocarbons from Natural Gas—the Fischer–Tropsch Process in the Argentine. B. Rikles. *Bol. del Inst. Sudamericano del Petroleo*, 1947, **2**, 543–593.—The history of the Fischer–Tropsch process is traced from 1923 to the present day, and the significant variables in the process reviewed. The Argentine Government had included in forward planning for a pipeline from the fields at Comodoro-Rivadavia to Buenos Aires (1800 km) to transport 1 million cu. m of natural gas/day for industrial and domestic use. If a hydrocarbon-synthesis industry from natural gas were established in the Argentine, sufficient gasoline could be produced to satisfy the country's requirements, subsidiary products would be obtained from the Fischer–Tropsch plants, and heavy crudes at present cracked would be released for fuel oil.

The suggestion is also made that conversion of certain coal deposits in the Argentine to liquid hydrocarbons would be an economic proposition, where such deposits are not normally worked due to high transportation costs. A. C.

1080. Factors Influencing Establishment of a Synthetic Liquid Fuel Industry in Western Canada. T. E. Warren. *Canad. Chem. & Process Ind.*, 1948, **32**, 318–321.—The application of hydrocarbon synthesis to natural gas and coal, and that of direct hydrogenation to coal, heavy crude oils, and bitumen are described. The production of heavy crude suitable for such a process could be stepped up considerably if necessary; systematic drilling in the Mildred–Ruth Lakes area on the Athabasca river alone had shown a reserve of bitumen in excess of 300 million brl. The coal reserves, assuming a synthetic oil industry of 30,000 b.d., were of several hundred years duration, but the rate of coal production would have to be greatly increased. A. C.

Metering and Control.

1081. Maintenance of Indicating and Recording Instruments of Oil Refineries. E. D. Nuneviller and D. M. Considine. *Oil Gas J.*, 22.4.48, **46** (51), 90.—Upkeep of electronic instruments was at first a source of worry to refinery managers, but experience has shown that electronic experts are not required to use or maintain them, and maintenance costs have even decreased since their introduction. Maintenance of such instruments usually reduces itself to checking resistances and voltages.

An electronic potentiometer consists of the following components: conversion stage; converter; transformer; voltage amplifier; power amplifier; balancing motor; and indicating and recording means. The functions of these are summarized and illustrated by a schematic diagram.

Procedure for general testing and trouble isolation is outlined under the following headings: equipment required; checking where no balancing motor drive is obtained; checking where balancing motor drives in one direction; checking for loss of sensitivity or speed, and checking for calibration shifts. W. M. H.

1082. Sampling Methods for Liquids. No. 193 in the Refiner's Notebook. W. L. Nelson. *Oil Gas J.*, 22.4.48, **46** (51), 121.—The weighted bottle is the most widely used container for sampling. It is illustrated by a diagram, and consists of a bottle with a weight and string attachment fastened to bottle and cork, so that a jerk on the line will uncork the bottle at a suitable level. Spot samples are usually taken at various levels: upper samples at a point 10% of depth of oil; middle samples, at half the depth of liquid; and bottom samples, at 10% of the depth. These are mixed for a composite sample.

Continuous sampling is employed for pipeline or various process liquids. The

dipper method may be used, in which samples of the full stream of liquid are obtained at uniform intervals, and mixed into a composite sample. Continuous sampling requires sample cocks, with lines leading into the pipeline or vessel. The A.S.T.M. recommends a three-cock arrangement, opened so that one-tenth of the liquid flowing is diverted. W. M. H.

1083. Instrumentation as Applied to Speed Control. J. G. Wilson, H. M. Karr, and M. V. Long. *Refiner*, Mar. 1948, **27** (3), 150.—This paper is concerned with the speed control of gas engines, steam engines, and steam turbines driving compressors. The functions required of a speed controller are described, the main ones being proportional and reset response, and in some machines a control of maximum rate of acceleration and/or speed droop is required. Various types of speed-sensing devices are outlined, such as the flyball, the drag cup, the tachometer generator, and the impedance bridge. Diagrams and descriptions of the operation of the more common speed governors are given, including flyball control plus hydraulic servo with proportional band and reset adjustments; an oil-pressure type of governor is also described. The hysteresis or the overall dead band of governor systems is discussed, and the application of the various governors to different type of engines is outlined. H. A. C.

1084. Chemical Process Control with Radioactivity. A. P. Schreiber. *Chem. Engng*, 1948, **55**, 103–105.—Applications of radio-isotopes and tracer techniques to industrial problems are discussed. Control of process variables, *e.g.*, concentration, is possible by the addition of a radio-isotope of the raw material, using a Geiger counter coupled with a suitable servo-mechanism. Alarm systems can be arranged where toxic gases are involved, by measuring the concentration of such gases, when radio-isotopes have been introduced, by Geiger-counter measurement. Location of exact leakage spots can be made with a portable Geiger counter.

By the back-scattering of radio-activity from a solution, the S.G. of the latter can be quickly estimated, and this system can be adapted for inspecting pipes and tanks for internal corrosion, without interference to production processes. Liquid-level measurement can be made using a float containing a hard gamma emitter, and a fixed Geiger counter. It is also possible to trace the course of chemical reactions by radio-activity means. R. T. W. H.

1085. Tank Calibration. Anon. *J. Inst. Petrol.*, 1948, **34**, 288–307.—The recommendations of the Tank Calibration Panel of Standardization Sub-Committee No. 1 of the Institute of Petroleum are set out.

These cover the calibration of oil-storage tanks by the "tank strapping" and "internal diameter" methods. Also, specifications for the apparatus to be used are included in appendices. A. R. W. B.

PRODUCTS.

Chemistry and Physics.

1086. Density of Adsorbates. N. G. M. Tuck, R. L. McIntosh, and O. Maass. *Canad. J. Res.*, 1948, **26B**, 20–37.—The adsorption isotherm and the apparent density of the adsorbate have been measured in the systems carbon tetrachloride–charcoal and diethyl ether–charcoal. In both systems the apparent density of the adsorbate is lower than the normal liquid density. The results are consistent with the concept of a blocking-off by the adsorbate of a portion of the internal voids of the charcoal, and are compared with the theoretical isotherms calculated from the Langmuir and Harkins–Jura equations. D. F. J.

1087. Catalytic Action of Aluminium Silicates. II. Dehydration of Butanediol-1 : 3 and Butanediol-1 : 4 over Activated Morden Bentonite. A. L. Bourns and R. V. V. Nicholls. *Canad. J. Res.*, 1948, **26B**, 81–88.—The dehydration of butanediol-1,3 over activated Morden bentonite was investigated in the range 250–350° C. The gaseous products consisted of propene and butadiene-1 : 3, the maximum butadiene yield being 29%.

The bentonite catalyst is therefore inferior to the acid phosphate catalyst for the production of butadiene.

Butanediol-1 : 4 over the bentonite catalyst at 250–300° C was converted to tetrahydrofuran in almost theoretical yield. This compares favourably with the results previously reported using other catalysts. At 400–500° C gaseous decomposition occurred, the main products being propene and formaldehyde. D. F. J.

1088. Measurement of Carbon Black Particles by the Electron Microscope and Low Temperature Nitrogen Adsorption Isotherms. R. B. Anderson and P. H. Emmett. *J. appl. Phys.*, 1948, **19**, 367–373.—Electron micrographs and low-temperature (−195° C) nitrogen adsorption isotherms have been compared on six carbon blacks as methods for obtaining particle size and surface-area values of finely divided materials. Good agreement was obtained with the four non-porous blacks, but with the two porous blacks the surface areas as measured by the isotherms were five to seven times greater than those calculated from the electron microscope results. D. F. J.

1089. Diffusion across Oil–Water Interfaces. E. Hutchinson. *J. Phys. & Colloid Chem.*, 1948, **52**, 897–908.—The rates of diffusion of a number of alcohols from water into benzene across the benzene–water interface have been measured at 25° C. The initial rates are in the order amyl > butyl > propyl > ethyl. The retarding effect of surface-active materials (*e.g.*, sodium cetyl sulphate) on the diffusion has been investigated and measurement of the interfacial tensions of the various systems supports the hypothesis that interaction in the film is responsible for retardation. D. F. J.

1090. Atomic Oxygen and Dissociation in Flame Gases. W. T. David, C. Rounthwaite, and N. Carpenter. *Nature*, 1948, **161** (4097), 726.—Tests of the flame gases at various points above the combustion zone of mixtures containing (*a*) oxygen with excess carbon monoxide or methane, (*b*) carbon monoxide or methane with excess oxygen, showed the presence of atomic oxygen with mixtures (*b*), and its absence with mixtures (*a*). Temperature differences of the order 300° C between the various zones of the flame with mixtures (*b*) point to the presence of considerable concentrations of atomic oxygen. In these experiments at atmospheric pressure the reaction zone is very narrow, but at low pressures it is greatly extended, and with very rich mixtures at 0·15 atm. temperatures exceeding 1850° C have been obtained. H. C. E.

1091. Flow of Gases and Vapours through Adsorbing Porous Media. R. H. Tomlinson and E. A. Flood. *Canad. J. Res.*, 1948, **26B**, 38–53.—The flow rates of gases and vapours through highly activated charcoal rods have been measured using a modification of the apparatus of Hodgins *et al.* The system of holding the carbon rods allowed for the small volume changes occurring during adsorption and desorption. Results are presented for the gases helium, hydrogen, nitrogen, carbon dioxide, diethyl ether, and ethyl chloride. The strongly adsorbed vapours of diethyl ether and ethyl chloride pass through the charcoal at rates considerably in excess of those required by equations such as that of Adzumi. D. F. J.

1092. Flow of Fluids in Pipes. L. C. Bull. *J. Inst. Heating Ventilating Engrs*, 1948, **15**, 449.—The mathematical derivation of laws governing the flow of fluids in pipes is given and the influencing factors are discussed. The *equivalent roughness* of various commercial pipes such as drawn tubing, commercial steel, wrought iron, asphalted cast iron, galvanized iron, cast iron, wood stave, concrete, and riveted steel is given. An example for calculation of pressure drop in a steel pipe is worked out. J. T.

1093. Chemical Nature of Natural Inhibitors in Petroleum. N. V. Razumov. *Neft. Khoz.*, 1948, (5), 37–42.—Cracked gasolines from Ekhabinsk fuel oil have exceptionally high induction periods (1200–1600 min); the fractions boiling below 175° C being less stable (130 min) than those in the range 175–200° C (>3000 min). Treatment of such gasolines with NaOH reduces the stability. Examination of the NaOH extract shows presence of monohydric phenols, 0·36% being obtained from a gasoline of d_4^{20} 0·761, boiling range 38–222° C. Chemical analysis showed the following to be present, *o*- and *p*-cresol, and 1 : 3 : 5-, 1 : 2 : 4-, 1 : 4 : 2-, and 1 : 3 : 4-xylenols.

Examination of the crude, fuel oil, and straight-run distillates showed absence of any phenols, but the crude and fuel have high ester values indicating possible presence of phenolic esters. It is suggested that owing to their high natural stability the vapour-phase clay treatment of such gasolines is unnecessary. V. B.

1094. Boiling Points of Compounds of the Aliphatic Series. N. S. Kozlov. *Neft. Khoz.*, 1948, (4), 47–51.—A continuation of previous work (see Abstract No. 923 (1948)). Factors are given for the quantitative lowering of boiling points due to the double bond, depending upon the relative position of the latter, and for various positions of a substituent methyl group, leading to a formula relating the boiling points of an alkene to that of the *n*-alkane with an equal number of C atoms. Literature values of the boiling points and those calculated by the author are listed for 124 alkenes; it is suggested that numerous recorded values (*e.g.*, those for 4 : 4-dimethyl-1-pentene; 2 : 4-dimethyl-2-hexene) are erroneous. Values for some as yet unsynthesized alkenes are also suggested. V. B.

1095. Reaction of Hydrogen Atoms with Butadiene. W. H. White and C. A. Winkler. *Canad. J. Res.*, 1948, **26B**, 3–6.—Hydrogen was partially decomposed in a Wood's discharge tube and the resulting hydrogen atoms reacted with butadiene at 28° or 252° C. The percentage of butadiene converted was high (*ca* 34%), and temperature had little effect on either the nature or the relative proportions of the product. A possible mechanism for the reaction is outlined. D. F. J.

1096. Thermodynamic Properties of Ethane. C. H. Barkelew, J. L. Valentine, and C. O. Hurd. *Chem. Eng. Progr.*, Jan. 1947, **43** (1), 25–38.—Previous studies of the properties are evaluated. Present tables give values for mol. wt., ice point, critical state, vapour pressure, heat capacities, and enthalpies. J. G. H.

1097. Alkylation of *iso*Paraffins with Olefins in the Presence of Sulphuric Acid. Part II. The Action of Sulphuric Acid on the Trimethylpentanes. F. Morton and A. R. Richards. *J. Inst. Petrol.*, 1948, **34**, 133.—The action of sulphuric acid upon various trimethylpentanes has been studied, and it is shown that using 98·5% acid at 10° C the order in which the trimethylpentanes react is 2 : 3 : 4-trimethylpentane >2 : 2 : 4-trimethylpentane >2 : 2 : 3-trimethylpentane. The main reaction is a disproportionation accompanied by isomerization. The rate of isomerization is slow and cannot be regarded as a major reaction in the alkylation of *iso*paraffins with olefins.
A. R. W. B.

1098. New Equation Relating the Molecular Weight of Petroleum Hydrocarbons and Petroleum Fractions to the Specific Gravity and Boiling Point. V. P. Voinov. *Neft. Khoz.*, 1948, (5), 52–53.—The following equation is suggested: $M = (7K - 21{\cdot}5) + (0{\cdot}76 - 0{\cdot}04K)t + (0{\cdot}0003K - 0{\cdot}00245)t^2$ where K is the characterization factor and t the boiling point at atmospheric pressure. K can be expressed in metric units as

$$K = \frac{1{\cdot}126(273{\cdot}2 + t)^{0{\cdot}333}}{0{\cdot}99486d + 0{\cdot}009148}$$

where d is the sp. gr. at 20/4° C. In this case t is the molal average boiling point.
V. B.

1099. Standard Samples of Hydrocarbons. Anon. *Petrol. Engr*, Feb. 1948, **19** (5), 105.—The article describes the progress that has been made in the National Bureau of Standards work on standard hydrocarbons. The aim of the programme is 1 litre of material of 99·8 mol % purity for use as standard samples and 0·2 litre of material of higher purity. Up to July 1, 1947, 119 compounds had been completed as standards.

The purifications are usually accomplished by a series of two, three, or four distillations, regular or azeotropic, at high efficiency and high reflux ratio. The purity is determined by measurements of freezing point. In addition to purity, three compounds are certified with respect to values of density and refractive index, these being No. 217, 2 : 2 : 4-trimethylpentane; No. 218, methyl*cyclo*hexane; and No. 211, a toluene. The 2 : 2 : 4-trimethylpentane is also certified for calorimetric heat of combustion.
G. K. A.

1100. Application of Thermodynamics to Hydrocarbon Processing. (Part IX.) W. C. Edmister. *Refiner*, Mar. 1948, **27**, 113.—High-pressure refining processes have been responsible for most of the work done on hydrocarbons in this field. P-V-T data is necessary for sizing processing equipment and also for deriving such necessary functions as fugacities, entropies, and enthalpies, etc. The author suggests that in view of the number and complexity of hydrocarbon systems it appears that the most practical procedure for deriving thermodynamic properties for petroleum is to use a graphical residual volume method and spot check by rigorous equation of state calculations and also by observed values of enthalpy, etc. Experimental determination of P-V-T data involves measuring four variables, two intensive, pressure and temperature, and two extensive, mass and volume.

The most convenient graphical P-V-T correlation is the compressibility plot, *i.e.*, $\frac{PV}{RT}$ *vs.* P_R the reduced pressure, and T_R, the reduced temperature. The isometric form of the P-V-T plot is also discussed and the slopes and intercepts are worked out from Van der Waals' constants. The compressibility factor at the critical point for all gases which follow Van der Waals' equation of state is derived from the values of the critical pressure, temperature, and volume in terms of a and b. The author also discusses the use of volume residuals α, where $V = \frac{RT}{P} - \alpha$. A graph of α, against P_r is given to illustrate the use of volume residuals. H. A. C.

1101. Specific Heats of Volatile Liquids. G. C. Williams. *Industr. Engng Chem.*, 1948, **40**, 340.—An apparatus and method are described for determining the specific heats of liquids which are near their boiling points. J. D. T.

1102. Substitution and Polymerization Reactions of Thiophen and the Isomeric Thiophthens. J. Bruce, F. Challenger, H. B. Gibson, and W. E. Allenby. *J. Inst. Petrol.*, 1948, **34**, 226–235.—Thiophen is polymerized by anhydrous ferric and stannic chlorides giving amorphous solids which have not been freed completely from the polymerizing agent. Solid thiophthen (thiopheno-2′ : 3′-3 : 2-thiophen) gives dibromo-, di-iodo-, and dinitro-derivatives. The halogenation is accompanied by formation of polymers, which give a blue colour with sulphuric acid. Similar polymers are produced with hydrogen bromide or syrupy phosphoric acid in glacial acetic acid and with sodium hypobromite and hydrochloric acid and as by-products in the preparation of thiophthenyl alkyl ketones by the Friedel–Crafts reaction using stannic chloride as catalyst. The corresponding polymers from liquid thiophthen (thiopheno-2′ : 3′-(or 4′ : 3′)2 : 3-thiophen) give a deep red colour with sulphuric acid and in benzene solution a magenta-coloured loose addition product with mercuric chloride. Isomeric dithienyls are contained in the higher-boiling fractions obtained in the preparation of the thiophthens from acetylene and boiling sulphur. A. R. W. B.

1103. Viscosity of Solutions of Primary Alcohols and Fatty Acids in Benzene and in Carbon Tetrachloride. W. J. Jones, S. T. Bowden, W. W. Yarnold, and W. H. Jones. *J. Phys. & Colloid Chem.*, 1948, **52**, 753–760.—Binary systems of alcohols and benzene, fatty acids and benzene, alcohols and carbon tetrachloride, and fatty acids and carbon tetrachloride were studied to determine how viscosity varied with composition. In particular, it was sought to ascertain how the positions of minima of viscosity moved as the homologous series of alcohols and acids were ascended. Ostwald-type viscometers were used and measurements were carried out at 25° C. None of the relationships proposed for the viscosity of a mixture of liquids affords proper representations when applied to the systems studied. D. F. J.

1104. Viscosity of Lubricating Oils at High Rates of Shear. H. Blok. *Ingenieur*, 21.5.48, (**21**), Mk. 58–63.—From a review of the experimental results available, the viscosity drops, claimed to be due to high rates of shear, can be attributed to thermal effects. For oils containing polymerized additives a real viscosity drop has been detected. It is suggested that a rotational viscometer of the Couette type with controlled heat fluxes be used in future experiments, as the thermal effects can be readily corrected for with this instrument. N. C.

1105. Rate of Wear in the Region of the Validity of Amontons' Law. H. J. Bezer and R. Schnurmann. *Nature*, 1948, **161** (4097), 728.—Measurements were made on a four-ball apparatus of the temperature rise of the steel cup (containing the three rigidly clamped steel balls) and of the frictional torque for various loads in the region for which, in conjunction with the three lubricants employed, Amontons' Law is valid. The temperature rise was used to calculate the frictional work, and the frictional torque to calculate the total work. Measurement of the final wear diameters gave the amount of metal abraded, and the work required for its abrasion was calculated. It was found that the work done by abrading the steel balls was about 1/1000th of the total frictional work, the major portion apparently being used for shearing the boundary layer.
H. C. E.

Analysis and Testing.

1106. Doll House Laboratory Speeds Oil Research. Anon. *Petrol. Engr*, May 1948, **19** (8), 110.—A petroleum microlaboratory effectively speeds up oil research. Results are achieved by working with very small quantities of material. Some advantages are: (1) conservation of expensive and scarce material; (2) saving of two-thirds laboratory space; (3) explosive and other dangerous materials may be safely dealt with in such small quantities.
C. G. W.

1107. Design of an Electro-magnet for the Magnetic Separation of Mineral Concentrates. R. Saporte and P. Canal. *Rev. Inst. Franç. Pétrole*, 1948, **3**, 13–22.—Constructional details are given of a magnetic apparatus, giving nine different values of magnetic field, suitable for separating small grains of mineral. Grain size is not critical, but should preferably be 40–60 mesh. At a distance of 1 mm the apparatus gives a maximum field of approximately 5000 gauss.
V. B.

1108. Simple Chemical Analysis of *iso*Butene in Binary Mixtures with other Olefins. J. P. W. Houtman. *J. Inst. Petrol.*, 1948, **34**, 255–268.—A simple method of analysis has been developed for binary mixtures of *iso*butene with propene, butene-1, butene-2, *iso*butane, and butadiene, using aqueous hydrochloric acid at room temperature as a reagent and the Bunte method of gas analysis. Only *iso*butene reacts with formation of *tert.*-butyl chloride. The other gases possess, however, a fairly considerable solubility in the reagent, for which it is necessary to apply a correction. Undiluted mixtures can be analysed with an accuracy of approximately 1% when containing less than 85% of *iso*butene. Above this value it is advantageous to dilute the gas with an equal amount of indifferent gas, such as air, in which case the same accuracy will be reached. Only mixtures with butadiene show a different behaviour when using the latter method.
A. R. W. B.

1109. Low Temperature, Low Pressure Fractionation. Natural Gas. E. H. Boomer, A. Gillies, and J. T. Hugill. *Canad. J. Res.*, 1948, **26B**, 202–214.—A simple, inexpensive apparatus is described which can be used to carry out routine analyses of small (usually 85 cc) samples of natural gas or similar mixtures. Analyses are accurate to 0·05% in lean gases and 0·1% in rich gases. A complete analysis takes about 2½ hr and consumes 3 lb liquid air.
D. F. J.

1110. Evaluation of Motor Oils by the Underwood Oxidation Test. L. H. Stranahan. *Lubr. Engng*, Feb. 1948, **4**, 28–31.—The necessity for evaluation in order to maintain a consistent quality of heavy duty oils is stressed, and brief descriptions are presented of the Indiana oxidation test, Norma-Hoffman bomb oxidation test, and the MacCaull corrosion test.

The Underwood corrosion test developed by General Motors Corpn sprays heated oil, which has been circulated by a pump, against the bearings. The oil is heated to 325° F, circulated at 10 p.s.i. pressure, and sprayed against a copper baffle and a cadmium–silver bearing for 5 hr. Bearings are weighed and samples of oil removed at regular intervals, corrosion being measured by the weight-loss of bearings, while the properties of the oil samples indicate stability or oxidizing properties. Detailed procedures are given for cleaning and operating the test equipment; the significance of Underwood Loss, corrosion index, neutralization number, naphtha insoluble,

chloroform soluble, carbon residue, and viscosity increase are discussed with illustrations of variations with individual oils. Breaking-in routine and the use of reference oils are described. J. G. H.

Crude Oils.

1111. Chemical Composition of Mineral Oils of Various Origins. H. J. Lunshof, J. van Steenis, and H. I. Waterman. *Chim. et Ind.*, 1948, **59**, 535–541.—Topped Sumatra crude was vacuum distilled to yield thirteen cuts and a residue. These were hydrogenated (275–280° C, over Ni catalyst at high pressure) to eliminate unsaturated hydrocarbons and also O, N, and S. Sp. gr., surface tension, mol. wt., and n (at eleven wavelengths) were determined on all the fractions both before and after hydrogenation. The mean number of rings and branches was calculated from the specific refraction and the parachor. The various results obtained are expressed graphically; by plotting the mol. wt. against the various physical constants the nature of the curves obtained gives some indication of the aromaticity of the crude under investigation. For comparison, similar curves are given for three other crudes. V. B.

1112. Middle East Crude Oils. L. C. Strong. *I.P.Review*, Apr. 1948, **2** (16), 123.—The international economic situation has caused great developments in the oil industry in the Middle East. These crudes, unlike those from the Caribbean area, are classed as "intermediate-wax bearing," and are of a paraffinic nature. They also contain relatively large amounts of sulphur. They therefore require the adoption of different refining techniques from those used previously in Europe. For instance, being paraffinic in nature they yield high-quality diesel oils, but relatively low-octane-rating gasolines. In the latter case, it is essential to use thermal reforming. From these crudes lubricating oils can be produced by conventional techniques. The same applies to bitumen production. In all cases, and particularly as regards diesel fuel, the high sulphur content necessitates special treatment. O. M.

Gas.

1113. Nitrogen Removal from Natural Gas. Pt. II. W. W. Deschner and W. W. Bodle. *Oil Gas J.*, 22.4.48, **46** (51), 92–98.—The separation of nitrogen from natural gas by low-temperature fractionation is essentially the separation of nitrogen from methane. Calculations on the fractionation system require liquid–vapour equilibrium data for nitrogen–methane mixtures, and available data are surveyed.

Gas-separation processes are accomplished by interchange of heat from incoming warm stream to outgoing cold stream, and by the supply of sufficient refrigeration to the system to offset heat leakage into it. The particular problems of this heat exchange with regard to natural gas are discussed, as are sources of refrigeration, the chief sources being Joule–Thompson expansion and the use of the expansion engine.

Details of three separation processes are given, together with flow sheets, material and heat balances, and power requirements. The first removes nitrogen from natural gas, but the nitrogen stream contains 56·7% methane, and is for use as a fuel gas. The second is superior in that only 10% methane is produced in the waste stream. A third scheme has been proposed which would result in a waste gas stream with only 1% methane.

The removal of carbon dioxide and hydrogen sulphide are discussed. W. M. H.

Engine Fuels.

1114. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. I. A Reaction Chamber adapted to Determine the Effect of Antiknocks on the Rapid Oxidation of Fuel Vapour at High Temperatures. R. O. King. *Canad. J. Res.*, 1947, **25F**, 326–342.—In an I.C. engine, complete oxidation of the reacting mixture occurs in a small fraction of a sec, and the last portion to burn is exposed to temperatures rising to 800° C. A reaction chamber is described which enables these conditions to be approached in the laboratory. The oxidation of pentane containing iron carbonyl in small concn is to the final products CO_2 and steam at all temperatures of reaction. The oxidation

of pentane alone, however, is accompanied by a profuse liberation of aldehyde, reaching a maximum rate at about 400° C and giving a negative temperature coefficient of reaction over the range 400–500° C. The reaction chamber was used less successfully in demonstrating the effect of tetraethyl lead owing to difficulties arising from the properties of the lead. D. F. J.

1115. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. II. Effect of Flow Configuration on the Velocity of the Oxidation Reaction in Pentane–Air Mixtures. R. O. King. *Can. J. Res.*, 1948, **26F**, 36–56.—Reynolds numbers for the commonly used rates of flow of a reacting mixture through a conventional combustion tube are far below the critical value. The laminar flow thus to be expected is disturbed by convection currents when the tube is heated. The flow configuration depends on such factors as ratio of length to diameter and temperature gradients, but can be varied by creating local differences of flow velocity within a uniformly heated reaction space such as reaction chamber No. 10 described in Part I (Abs. No. 1114). The effects on reaction velocity of the factors mentioned above have been determined by experiments described in this part. The results indicate that the oxidation of pentane is a heterogeneous reaction and that the velocity of such a reaction is determined by flow configuration. The reduction in reaction velocity obtained on packing an open combustion space is not due to an increase of surface but to the consequent change in the flow configuration of the reacting mixture. The paper is well illustrated by diagrams, graphs, and one photograph. D. F. J.

Lubricants.

1116. Equipment and Methods Employed at Thornton Research Centre. Anon. *Auto Engr*, Mar. 1948, **38** (499), 97.—The increasingly severe conditions of service under which modern automotive engines operate calls for higher grade lubricants and improved and standardized methods for their evaluation. At "Shell" Refining and Marketing Co's Thornton Research Centre the establishment of satisfactory standard methods and equipment for this purpose is being actively pursued. Such work as this demands very close co-operation between the engineers and chemists who operate and maintain the test engines and assess the quality of the oil from bearing wear, corrosion, piston cleanliness, etc. The chemists function is to determine the rate of deterioration of the oil, under the given test conditions, by carrying out physical and chemical examination of used oil and by analysis of crank-case sludges, etc. A third very important section of the organization is the Engine (Chemical) Servicing Section which deals with such problems as the standardization of techniques for measurement of air–fuel ratios, cleaning of components after test, descaling and removal of carbon deposits, etc. Special solvent mixtures have had to be developed for this latter operation.

The establishment of standard engine tests involving ease of disassembly presupposes the use of single-cylinder engines where constant conditions are most easily obtained. In some cases, such as field tests under simulated service conditions, multi-cylinder engines are preferred.

The whole question of engine testing is being reviewed under the auspices of the Institute of Petroleum with a view to attempting to develop a single-cylinder unit which will be equally suitable for ring-sticking, oxidation, and bearing corrosion tests. In this connexion the two units so far produced are the A.I.O. Co. gasoline unit and the Shell–Ricardo diesel engine.

To complete the evaluation of a newly developed oil, it is necessary to carry out road-tests. O. M.

1117. Foaming of Mixtures of Hydrocarbons. J. V. Robinson and W. W. Woods. *J. Phys. & Colloid Chem.*, 1948, **52**, 763–766.—A series of experiments is described which indicates that simple mixtures of hydrocarbons are capable of foaming although the constituents of the mixture taken separately do not foam. Likewise, mixtures of aliphatic hydrocarbons, or of aromatic hydrocarbons scarcely foam, whereas mixtures of aliphatic with aromatic hydrocarbons do foam. The foaming of lubricating oils is not therefore caused solely by stabilizing agents and the oil can be made non-foaming only by the addition of anti-foaming additives. D. F. J.

1118. Motor-Driven Grease Worker and its Application for Evaluating Consistency Stability of Lubricating Greases. C. W. Georgi. *A.S.T.M. Bull.*, Dec. 1947, **149**, 44–48.—The effectiveness of A.S.T.M. method D-217–47T calling for the working of a grease sample for sixty strokes in the A.S.T.M. worker prior to making cone-penetration tests is questioned on the grounds that some greases only soften on working up to 1000 strokes, 5000- and 10,000-stroke workings being common practice in many laboratories. Such increased workings call for the adoption of a motorized drive. The results of tests on motorized working up to 10,000 strokes with three reference samples from fourteen laboratories are given and the poorer reproducibility so obtained is discussed. Summaries of results with worked and unworked tests and with sixty-stroke-worked consistencies with hand- and motor-driven workers are considered. Modifications in the worker plate for the motorized grease worker and suggestions for the improvement of the hand-driven grease worker are put forward. J. G. H.

1119. Lubricating Oil Testing in Engines. R. Stansfield and J. C. Cree. *J. Inst. Petrol.*, 1948, **34**, 271–287.—An increasing use is being made of bench tests of oils in engines for purposes of grading, and in a few cases an oil specification includes such a test. There are recognized tests only for certain H.D. oils, but it should be possible to develop others to meet requirements in respect of normal and premium grades. An account is given of the results of standard tests in the Caterpillar single-cylinder diesel engine and in the Chevrolet petrol engine, and these are discussed in comparison with chemical-laboratory inspection data. Lack of significance of the latter led to a series of Chevrolet tests in which bearing-weight losses were determined at intervals during the run and the form of the corrosion curves determined. It was shown, however, that even when the breakdown time of the oil was known it still could not be reproduced satisfactorily by tests of the unused oil in the laboratory. The use of engine tests of lubricating oils leading to ring-sticking is discussed, and preference is given to ratings in terms of quantities and nature of deposits during runs which are not continued to the point of ring-stick. The need for reliable methods for determining whether a used additive-type oil is still active is emphasized, and suggestions are made for experimental work. Notes are included regarding the precautions to be adopted to obtain satisfactory life and freedom from mechanical trouble with the Chevrolet engines. A. R. W. B.

1120. Examination of Used Engine Lubricating Oils. K. Hilfreich, J. C. McNicol, and L. Rosenfeld. *J. Inst. Petrol.*, 1948, **34**, 148–207.—A considerable number of used engine-lubricating oils have been examined. The samples had been supplied by operators from many parts of the U.K. and the majority were without detergent-type additives—numerous physical and chemical tests were carried out on them. The work was chiefly concerned with determining the amounts of contaminating matter in the samples and obtaining information on the nature of the suspended solid. Incidental to the main objective, considerable information has been gained with regard to the significance and relative value of the different test methods. The test methods are described in detail. Results are presented in tabular form and in a number of graphs on 110 samples. The influence of various operational factors on oil contamination has been examined. Individual analyses have been critically examined and correlated, among these particle-size distribution, an important factor from the points of view of abrasive wear and oil filtration. A wide range of particle sizes was detected, with most oils a maximum concentration of particles was observed between sizes of 0 and 2 microns. Of the solid matter in the oil the greater part is carbonaceous and finely ground. From test results assuming an average type of engine the rate of accumulation of " petroleum ether insolubles " in the crankcase is calculated as 0·4 g/hr of C.I. engines and 0·2 g/hr for petrol engines. Finally, general methods of test are suggested for use in examining used engine lubricating oils.
A. R. W. B.

1121. Preparation and Properties of High Viscosity Index Motor Oils. W. L. van Horne. *Refiner*, Mar. 1948, **27**, 120.—The use of certain polymethacrylates to improve the viscosity–temperature behaviour of both crankcase and gear oils is described. The author shows that the use of such oil-soluble polymers offers a very flexible means of obtaining almost any viscosity oil together with a high viscosity

index. Tables are given of the improvement in viscosity index resulting from polymer addition; the Hardiman–Nissan viscosity-index values have been given together with the A.S.T.M. viscosity indices. Engine-test data is also presented. It is shown that there is a limit to the mol. wt. of the polymer added controlled by the breakdown under sheer of the higher polymers; however, the higher the mol. wt. of the additive the greater the improvement in the viscosity index of the oil.

H. A. C.

Special Hydrocarbon Products.

1122. Insecticidal Efficiency of Saturated Petroleum Fractions. G. W. Pearce, P. J. Chapman, and D. E. H. Frear. *Industr. Engng Chem.*, 1948, **40**, 284.—The insecticidal efficiency of narrow-boiling fractions prepared from white oils of paraffinic and naphthenic types was evaluated, using the eggs of the oriental fruit moth, Grapholitha molesta (Busk), as a test material. Correlations between physical properties and efficiency are made. J. D. T.

1123. Liquid Paraffin Risks. Anon. *Brit. Med. J.*, 1948, i, 1141.—Biological (rat) tests on effect of internal administration of liquid paraffin (B.P.), both unheated and heated to cooking temperature, do not indicate any unfavourable action other than loss of fat-soluble vitamins, which latter effect has been confirmed by human experiments. The possibility of carcinogenic activity from breakdown products of liquid paraffin heated to cooking temperature cannot, however, be excluded. The use of liquid paraffin should be strictly restricted to therapeutic purposes; the internal use of other, less refined, mineral oils is highly undesirable. V. B.

Derived Chemical Products.

1124. Production of Synthetic Alcohol from Ethylene. C. M. Beamer. *Chem. Eng. Progr.*, Mar. 1947, **43** (3), 92–96.—The synthesis of ethyl alcohol from ethylene is reviewed in its historical background and compared with the production of *iso*propyl alcohol from propylene. Materials of construction and wartime uses are enumerated together with flowsheets; future status of the industry and possible raw materials are discussed. J. G. H.

1125. Structure and Properties of Ethylene Polymers. R. B. Richards. *J. Inst. Petrol.*, 1948, **34**, 237–246.—The variations in properties of ethylene polymers are to a great extent due to the variation in mol. wt., but properties such as hardness and elasticity modulus are dependent, too, on the degree of crystallinity of the solid. Factors affecting crystallization in waxes and polymers are discussed, in particular, the effect of chemical structure. A. R. W. B.

1126. Methanol Industry Makes Plans for the Future. A. A. Williams. *Chem. Engng*, 1948, **55**, 110–113.—A survey of methanol requirements in the U.S.A. for the next two years, and details of present production capacity and forthcoming methanol plant extensions. A brief history of synthetic methanol production is presented, together with an analysis of the sources of demand, which comprise mainly the anti-freeze market, and formaldehyde manufacture. R. T. W. H.

1127. Petroleum Chemicals Reviewed. Parts 1 and 2. R. F. Goldstein. *Petrol. Times*, 27.3.48, **52**, 327.—General developments in the U.S.A., indicated by production and sales figures for synthetic organic chemicals, are outlined. Methods and statistics of the production of aromatics such as toluene, xylene, ethylbenzene styrene, and polynuclear aromatics from petroleum, are briefly mentioned. C. G. W.

1128. Petroleum Chemicals Reviewed. R. F. Goldstein. *Petrol. Times*, 10.4.48, **52**, 379.—Various processes of air oxidation of paraffins are reviewed. Main products with lower hydrocarbons are acetaldehyde, acetone, acetic acid, etc. Liquid-phase oxidation of higher paraffins gives complex products usually separated into an acidic fraction and a fraction consisting of high-molecular-weight alcohols and ketones. A process operated in Germany derives long-chain fatty acids by oxidation of paraffin wax. Processes are briefly described. References are appended. C. G. W.

1129. Manufacture of Sulpholanes and Use as Selective Solvents. H. G. Staaterman, R. C. Morris, R. M. Stager, and G. J. Pierotti. *Chem. Eng. Progr.*, Apr. 1947, **43** (4), 148–151.—Sulpholanes, hydrogenated forms of diolefin-derived sulphones, have been developed as solvents for a variety of separation processes. The manufacture of dimethylsulpholane from diacetone alcohol by hydrogenation to hexylene glycol, followed by batch distillation and dehydration to methylpentadiene and completed by reaction in an autoclave with liquid sulphur dioxide is described and the use of sulpholanes as selective solvents is evaluated. J. G. H.

Coal, Shale, and Peat.

1130. Oil Shale Deposits of the World and Recent Developments in their Exploitation and Utilization, Reviewed to May 1947. W. H. Cadman. *J. Inst. Petrol.*, 1948, **34**, 109.—A brief survey is given of the oil-shale deposits in various countries of the world, and of some wartime and more recent developments. A general description is given of the nature and chemical composition of the oil shales and some oil-shale products. No attempt is made to include any detailed information. The enormous oil-shale deposits in the world primarily form a potential raw material for the production of oil. The paper indicates to what extent the exploitation of these potential oil reserves has been carried out, and also to what extent an economical method of obtaining oil from shale has been developed or is under development. The subject discussed is closely related to national self-sufficiency in case of future emergency in countries without indigenous oil supplies. It suggests a means of contributing to the increasing demands for liquid fuels, whilst the world's oil supplies are inevitably decreasing rapidly, and it may be of great importance as a potential source of oil when the oilfields of the world are ultimately exhausted. Reference is made to the Swedish discovery of uranium in oil shale. A. R. W. B.

1131. Comparison of Major Processes for Synthetic Liquid Fuels. D. C. Schroeder. *Chem. Ind.*, Apr. 1948, **62** (4), 574.—The increased demand in the U.S.A. for oil fuels and the uncertainty of new exploration supplementing the petroleum reserve of the nation may compel the production of large quantities of synthetic fuels from oil shale, coal, or natural gas. Three processes are at present under consideration in America for this purpose.

Production of Fuel from Oil Shale. The rock, on heating, breaks down yielding crude shale oil. From this material satisfactory fuel oil and diesel oil can be obtained, but the gasoline fraction is of too low an octane rating to be satisfactory. It is estimated that crude shale oil can be produced at from 2 to 2·5 dollars/brl.

Gas Synthesis Process. This process is based on the well-known Fischer–Tropsch process, which yields hydrocarbons by the catalytic reaction between carbon monoxide and hydrogen. The water–gas mixture for this process is supplied either by normal or underground gasification of coal or from natural gas, though the present high price of coal makes the latter raw material more economic. Use of a cobalt catalyst yields a high-grade diesel oil, but a low-octane gasoline. A power diesel oil and a 70-octane gasoline result from the use of iron catalysts.

Hydrogenation of Coal. Here coal is hydrogenated under high pressure at elevated temperature. The products from the process are particularly suitable for the manufacture of aviation gasoline. Light hydrogenation at low pressure has possibilities for the production of fuel oil. It may be possible to utilize natural gas as raw material and thus reduce the production costs. O. M.

Engines and Automotive Equipment.

1132. Scandia Discussed. Anon. *Flight*, 3.6.48, **53**, 607.—The Scandia is a new Swedish aircraft designed specifically to replace the now obsolete Dakota or D.C.3. Operational impressions are given together with a cut-away drawing of the aircraft and engine performance, and dimensions and weights are included in a comprehensive review. I. G. B.

1133. Recent and Future Developments in Diesel Engines. Anon. *Diesel Pwr & Diesel Transportation*, Mar. 1948, **26** (3), 106.—Recent major trends in diesel development are high speeds, increases in production, and improvements in design to increase loading. The naturally high thermal efficiency of the engine has been raised by utilizing the waste heat of the jacket water and exhaust gases for space heating and other applications.

Increased loading and higher efficiencies have been obtained by exhaust-driven superchargers, which increase the average b.m.e.p. of the four-stroke diesel by 50%. The chief limitation to the loading is the heat resistance of the engine, a difficulty which can be partly overcome by using detergent lubricating oils and by employing oil-cooled pistons. The heat load in supercharged engines can also be reduced by inter-coolers, which lower the inlet-air temperature.

The popularity of the diesel is partly due to the low cost of the fuel. Owing to the scarcity of petroleum, however, shale deposits and underground coal seams are now being used as sources of supply for the oil, and these new processes will probably increase fuel costs in the future. Large savings in fuel expenditure are now being made by the use of the gas–oil engine, which burns the fuel oil and natural gas in any percentage ratio.

The most general present-day uses of diesels are for railroad, truck, marine, and stationary engines, and they are not commonly used in the automobile and aviation field. Future applications of the diesel may be made even more widespread than they are at present by increased loading, and by a combination of the diesel and gas turbine.

C. D. B.

1134. Data on Engines Manufactured by American Diesel Engine Builders. Anon. *Diesel Pwr & Diesel Transportation*, Apr. 1948, **26** (4), 51.—In this, the Annual Diesel Specification Number, specifications of engines produced and marketed by fifty-two American engine manufacturers are listed, giving information concerning model, type, continuous rated horse-power, number of cylinders, bore and stroke, fuel injection equipment, dimensions, and weights. C. D. B.

1135. Anglo-Saxon Tanker "Auris". Anon. *Motor Ship*, Apr. 1948, **29**, 6.—This vessel has been completed, and full details are given of the performance and equipment. This comprises four Hawthorn Sulzer four-stroke engines, each developing 1100 b.h.p. running at a speed of 375 r.p.m. It will be recalled that arrangements have been made to replace one of the engines of the "Auris" with a gas turbine at a later date.

I. G. B.

1136. New Single-Plunger Fuel Injection Pump. Anon. *Gas Oil Pwr*, 1948, **43** (512), 134–137.—This injection pump has been designed for small diesel engines, and has less than half the size and weight of present pumps of equal capacity. It is of the cam-actuated constant-stroke throttled-intake type, and the single plunger acts as its own fuel distributor by virtue of its continuous rotary motion in addition to its reciprocating motion. Details of its construction are given with the aid of eight figures.

The fuel-supply system feeding the unit is described with special reference to the arrangements for returning surplus fuel to the storage tank. The quantity of fuel delivered per stroke is arranged to pass through a maximum as the engine speed increases by means of a retraction-volume piston on the delivery valve.

The pump is lubricated at 10 to 60 p.s.i. from the pressure line of the main engine.

H. C. E.

1137. Creep Resisting Alloys for Gas Turbines. A. J. Zuithoff. *Ingenieur*, 21.5.48, (21), Mk. 53–58.—A review of the developments in U.S.A., Great Britain, and Germany of alloys used for the manufacture of rotors, gears, and combustion chambers for gas turbines. Ten tables and graphs are included in the article. N. C.

1138. American Single-cylinder Oil Engine. Anon. *Gas Oil Pwr*, 1948, **43** (512), 153.—This unit, giving a b.h.p. of 8 at a top speed of 1200 r.p.m., has a cylinder 4½ in by 5 in, with a compression ratio of 16 : 1. Fuel injection is central through a multi-hole nozzle from Bosch or Bendix Scintilla equipment. Details of the mechanical construction, bearings, camshaft, and valve gear are given. H. C. E.

1139. Enfield Low-power High-speed Engines. Anon. *Gas Oil Pwr*, 1948, **43** (510), 90; 1948, **43** (511), 99–104.—The vertical single-cylinder engine and the horizontally-opposed twin-cylinder engine, both with cylinders of 85 mm bore and 100 mm stroke, have ratings of 5½–6 b.h.p. and 11½–13 b.h.p., respectively, at 1500 to 1750 r.p.m. The cylinder head is of a recently patented design, and embodies the direction of the fuel spray into the throat so that the descending piston tends to draw atomized fuel into the cylinder.

The general performance of the twin engine is illustrated by graphs of power output, exhaust temperatures, cylinder pressures, and fuel consumption. Details are also given of the cylinder-pressure diagrams at various loads. Fuel injection through a single-hole C.A.V. nozzle begins 20° to 25° before t.d.c. at a pressure of 150 atm. Specific fuel consumption for the single-cylinder and twin-cylinder units are 0·432 and 0·4 lb per b.h.p.hr, respectively, at 1500 r.p.m.

The construction of the frame, cylinder barrels, and moving parts are described in detail. Lubrication is effected at a maximum of 100 p.s.i., and an external filter is supplied.

The text is illustrated by ten graphs and diagrams. H. C. E.

BOOK REVIEWS.

Chemical Engineering Fundamentals. Chalmer G. Kirkbride. New York: McGraw-Hill Book Co. Inc., 1947. Pp. 419 + x. $5.00.

"Chemical Engineering Fundamentals" is intended as a preliminary training for a chemical-engineering course, for use in the last half of the second year, and first half of the third year, of a four-year course by students who may only have had courses in general chemistry, mathematics, and physics. It thus includes, in addition to physical chemistry, also the requisite mathematics. Differential calculus is not introduced until late in the book, by which time the students would have taken differential calculus in the mathematics course.

The author was previously a Professor of Chemical Engineering at the Agricultural and Mechanical College of Texas, and is now Director of Research and Development of the Houdry Process Corporation.

An interesting feature of the book is the emphasis which is placed on human relations in chemical engineering, and this subject occupies the second chapter of the book. The following two chapters deal with mathematics and physical chemistry; the treatment of these subjects is, however, more suitable for a revision course than for an introductory course, and the section on organic chemistry could well have been omitted. The remaining two-thirds of the book are devoted to material, energy and economic balances, static and dynamic equilibria, and the writing of technical reports.

A final chapter deals with the presentation of technical results and, as pointed out in the Preface, the student will be influenced as regards his method on both human relations and technical report writing by the teachers in chemical engineering rather than by courses given in other departments. A large proportion of the example problems given in the book are taken from the petroleum industry, which is quite sound, since chemical engineering owes much of its development both in theory and in practice to the continuous methods of manufacture largely due to those engaged in the petroleum industry.

As mentioned, Chapter II deals with human relations in chemical engineering, and the author quite rightly emphasizes that success may depend as much on the ability to co-operate with his associates at all levels in industry as on his technical ability. It is, however, uncertain to what extent such a subject can be taught in the class-room as will be appreciated from one only of the questions in this chapter, No. 23. "What are five of the ten 'do's' and 'don'ts' in dealing with one's fellow men?"

"Chemical Engineering Fundamentals" can, however, be strongly recommended as an excellent introduction to chemical engineering. F. H. G.

Modern Oil Engine Practice. Edited by E. Molloy. 3rd Edn. London: George Newnes Ltd. 1947. Pp. 670 + xxiv. 30s.

First published in 1942, this compendium has now reached its third edition, and the opportunity has been taken to revise and add: The book is in two parts—theory and constructional details, and installation and maintenance. The first part is sub-divided into chapters under the headings: Principles and Operation; Development of the High-Speed Diesel; Development of the Marine Oil Engine; Fuel Injection and Combustion and C.I. Engines; The "Buchi" System; Torsional Vibration; Shop Testing; C.A.V. Fuel Injection Equipment; Recent Developments in 2-stroke C.I. Engines; The Gas Diesel; Bryce Injection Equipment and Hydraulic Governor; Simms Fuel Injection Equipment and Survey of Typical Designs. Chapters on the Bryce and Simms Injectors are additions, and the last chapter has been revised to cover the products of practically all the leading makers in Britain.

The second part is aimed chiefly at those engaged in erection, testing, and maintenance, and the following engines are discussed: Brotherhood Ricardo S.U.

engine; Belliss & Morcom; Gardner L.3; Blackstone types R.P., S.P., and E.P.V.; English Electric Fullagar; National; Petter Small Atomic; Petter Fielding; A.E.C. 6-cylinder. General notes on engine installation and routine inspection and maintenance are also included in Part II. An interesting addition is a set of engine-timing diagrams covering fifty of the most widely used types of C.I. engines.

The reviewer considers that the book will be most valued by erection and maintenance engineers. Little effort has been made to give a critical analysis of the various engines. A section on the choice of the most suitable engine for a given purpose would add considerably to the merits of the book. I. G. B.

National Fire Codes. Volume I. Flammable Liquids, Gases, Chemicals, and Explosives. Boston: National Fire Protection Association. 1948. Pp. 608. $4.00.

The National Fire Protection Association, which has been most successfully operating for many years in the U.S.A., has no counterpart in Great Britain, though it may be expected that the relatively newly formed Fire Offices' Committee Fire Protection Association will, in due course, develop along somewhat similar lines. Until that time, however, it is to the N.F.P.A. that all in search of technical information on the subject of fire prevention or fire protection automatically turn. One of the most important ways in which this body seeks to reduce fire wastage is through a comprehensive series of publications, on general sale to the public, outstanding in which are the five volumes which constitute the National Fire Codes.

These codes are drawn up in the form of ordinances, standards, by-laws, or codes of good practice, and it is suggested that they may be adopted in whole or in part by State or Municipal authorities who are proposing legislation in this field. Quite apart from any use which may be made of them for legislative purposes, they are invaluable as guides to good practice for property owners, insurance interests, etc. They have no counterpart in Great Britain except that the Ministry of Works in collaboration with the British Standards Institution and certain technical bodies are preparing a very limited number of Codes of Practice for installations in buildings and that some of the N.F.P.A. Codes are, partially at least, covered by legislation such as the Petroleum (Consolidation) Act, 1928, and Regulations made thereunder, the Cellulose Solutions Regulations, 1934, the Explosives Acts, etc.

The contents of this volume are adequately described in the title. In all, some forty-three Codes are presented divided into seven parts. These are: 1. Flammable Liquid Storage and Handling; 2. Oil and Gasoline Burning Equipment; 3. Liquefied Petroleum Gases; 4. Utilization of Flammable Liquids; 5. Gases; 6. Refrigeration and Fumigation; 7. Explosives and Nitrocellulose Materials. An eighth part is devoted to tables and a ninth to flash-point tests, whilst an appendix gives a draft ordinance for establishing a fire-prevention department—of little interest in Great Britain since the matter is adequately covered by the Fire Services Act of 1947.

Each of the Codes has been prepared by a technical committee drawn from a wide range of interests, and each is revised at suitable intervals in the light of the most recent experience. They therefore represent the most modern practice, though it will be realized that the Codes are prepared for conditions in the U.S.A., and these do not apply in their entirety to other countries. V. J. W.

S.P.I. Handbook. New York: Society of the Plastics Industry. 1947. Pp. 451 + xxx. $7.50.

This book originated in a request by the Technical Subcommittee on Plastics of the United States combined armed forces for more extensive data on plastic materials than was generally available in handy form. A number of subcommittees, composed of some of the outstanding American plastic technologists, was formed by the Society of the Plastics Industry of New York. A vast body of information was collected, and much of it appears in this handbook for the benefit of anyone anxious to make use of it.

The book is well printed on good paper, and is provided with an excellent index. It is copiously illustrated with diagrams, photographs, and tables of reliable data on the properties of plastic materials. Being written by a committee or, to be more true, a series of committees, it has both the faults and the virtues of such a work. It is authoritative and contains only worthwhile information, but there is a certain repetition of matter and diversity of styles and methods of approach that make

prolonged reading rather tedious. But it must be admitted that it is offered as a reference book, and as such is not meant to be read from cover to cover. It should also be stressed that it is addressed to the fabricator of plastic materials and not to the student of chemistry, the resin maker, or the producer of sheet materials. The emphasis is on production engineering.

Chapter 1 lists the materials available and refers the reader to the relevant A.S.T.M. tests for the properties embraced. Chapter 2 deals with the fundamental facts of moulding (compression, injection, transfer, jet, and low-pressure), extrusion, casting, and forming thermoplastic sheeting. Much of this chapter is very well written, and it contains excellent diagrams of the machinery and of the processes used. Chapter 3 covers the design of moulded articles from the engineering point of view, and Chapter 4 deals with inserts giving valuable advice on the principles governing successful production. The subject of tolerances is treated in Chapter 5 by tables. Chapter 6 discusses the cementing and assembly of plastic components. A British reader will find the section dealing with thermo-plastics very much more satisfactory than that dealing with thermo-setting products; since, in the latter, treatment is by way of proprietary adhesives, for the most part not known in this country, and does not give clues for finding British equivalents.

Chapter 7 considers methods of mechanical test. It is rather too short to cover adequately all suggested by its title. Chapter 8 gives advice on the choice of steels for moulds and on their design. Dealing with all types of mould, many readers may find this excellent chapter the best in the book. Chapter 9 is devoted to methods of machining and finishing plastic articles and is very thorough. Chapter 10 is entitled "Laminated Products and their Fabrication." It lists the various materials for which there are N.E.M.A. specifications and gives in tables their properties; and finally a few pages are devoted to working with these materials. This chapter, in the opinion of the reviewer, is the least satisfactory. The user of laminated products ought to appreciate the differences between phenolic and cresolic resins, between sodium and ammonium condensed resins, and between water and spirit solutions. As all these differences are reflected in the final product, such a book as this should encourage this appreciation and its intelligent use.

A number of omissions must be prepared for. Polyethylene is not mentioned as a material for injection moulding. Polyvinyl chloride does not occur even as a name in the index. No mention is made of polyethylene film, nor of any plastics used in packaging. Little information is given about furfural resins though much has been written on them in American literature, and materials which have only specialized uses, such as aniline resins, cellulose ethers, or polyvinyl alcohol, are either ignored or just mentioned as having existence. Dielectric heating as an aid for pre-heating moulding powders is not discussed. Other readers will find other omissions.

Many American books on technology have been viewed with disfavour in Great Britain for giving no critical comments on possible alternative processes or materials. This cannot be said about the handbook under review, as in many places the advantages and disadvantages of one process or material are weighed against another.

From the above it will be seen that the book caters exclusively for those whose daily concern is with plastic materials and with the problems associated with fabricating them into articles for general commerce. To such people the book can be confidently recommended. To others it will give a clear outline of the processes adopted in the industry, being rather more sound than many even if a little less easily read. It will, of course, be appreciated that this is an American book written primarily for Americans, and that a British reader must remember that all the grades of materials in the two countries are not coincident and that the accepted specifications are not interchangeable.

J. M. J. E.

Synthetic Petroleum from the Synthine Process. B. H. Weil and J. C. Lane. New York: Remsen Press Division, Chemical Publishing Co. Inc. 1948. Pp. 303 + x. $6.75.

The publication of the first textbook on the Fischer–Tropsch process is to be welcomed. A few years ago, hydrogenation was regarded as the only suitable "synthetic" process for making motor spirit from coal, and indeed the spirit

fraction of all the Fischer–Tropsch primary product made in Germany was of poor quality. Certain investigations carried out in Germany, however, gave promise of changing this situation. As a result of similar investigations in America, a modified process has been developed which yields motor spirit of 80 octane number. The combination of these improvements, and the cheap raw materials which are available in the U.S.A., make the process an economic possibility, although it cannot yet compete with natural petroleum as a source of motor spirit.

The Fischer–Tropsch process is, in consequence, attracting a great deal of attention in the U.S.A., where both the Government and the oil industry are engaged in research and development work. There is a large and growing literature describing work on the process, which now includes the reports of the Allied investigations in Germany. The publication of the present book is therefore opportune. It is a survey of the literature of the Fischer–Tropsch synthesis, and covers comprehensively the period up to about the end of 1946. It serves as an introduction to the subject, and indicates past achievements and future possibilities, but its greatest value will certainly be as a guide to the literature.

The main part of the book is divided into four parts dealing with (I) Synthesis Gas, (II) The Catalytic Synthesis, (III) Products and By-Products, and (IV) Basic Economics. References to patents and recent papers are given in Appendices. The book is written from the American standpoint, and Part IV (Basic Economics) is therefore concerned with the economics of the Fischer–Tropsch process in the U.S.A. This is, however, no great disadvantage to the British reader. The centre of interest in the Fischer–Tropsch process lies in America, and the results of the work now in progress there will greatly influence commercial development in the rest of the world.

The book has certain shortcomings which must be mentioned, especially as they may be more apparent to the British reader than are its merits. In the first place the title is unworthy of the book; it suggests a newspaper article rather than a serious scientific survey. The term "Synthine" for "Fischer–Tropsch" may have come to stay in the U.S.A. (though this is doubtful), and the British reader will see little purpose in attempting to jettison the more familiar term. A more serious defect from the point of view of the British reader concerns the literature references which are given in the bibliography at the end of each chapter. They include references to reports of Allied investigations in Germany, but these are for the most part to American publications, issued by the Office of Technical Services of the Department of Commerce, which are not readily available in Great Britain. Most of these reports are also published as B.I.O.S., C.I.O.S., or F.I.A.T. reports, but the references to these are not given. C. M. G.

BOOKS RECEIVED.

Compressed Air Handbook. New York: Compressed Air and Gas Institute, 1947. Pp. 387 + v. $3.00 in U.S., $3.50 elsewhere.

Compiled and edited jointly by the Educational and Technical committees of the Compressed Air and Gas Institute, this volume presents useful data on compressed air and gas as a source of power. Its five chapters deal respectively with typical applications, types of compressor installations, portable tools and rock drills, engineering the compressor installation, and compressed-air engineering data and test procedure.

The book is profusely illustrated by photographs and line drawings, and many tables and formulæ are given.

The Engining of Cargo Vessels of High Power. London: The Institute of Marine Engineers, 1948. Pp. 86. 10*s.* 6*d.*

The six papers which formed the symposium on this subject, which was presented and discussed at a meeting of the Institute of Marine Engineers in November 1947, have been issued, with a full report of the discussion, as a separate publication.

The papers deal with The Geared Steam Turbine (T. W. F. Brown), The Direct-coupled Diesel Engine (C. C. Pounder), The Geared Diesel Engine (C. C. Pounder),

Diesel Electric Propulsion (J. G. Belsey and J. G. Robinson), Turbo-Electric Propulsion (C. W. Saunders and T. H. Turner), and the Combustion Turbine (J. Calderwood).

In a summary of the papers S. F. Dorey says that " they will be found useful not only by marine engineers but also by those whose business is to run a ship in an economical manner." Detailed explanations of certain parts of machinery are included and information on fuel consumption and on lubricating-oil consumption.

Alberta Motor Gasoline Surveys, 1939–47. J. S. Charlesworth and E. Tipman. Edmonton, Alta : Research Council of Alberta, 1948. Pp. 11.

Average analyses are given of premium and regular grades of gasoline marketed in Alberta in the winter and summer periods of the years 1939 to 1947. The Alberta Government specifications for these grades are also listed.

The testing of the samples has been carried out by the Gasoline and Oil Testing Laboratory which, established by the Provincial Government Department of Trade and Industry in 1939, was taken over by the Research Council in 1943.

Transactions of the Instruments and Measurements Conference. Pp. 252.

This Conference was held in Stockholm in 1947 and the papers presented are reproduced in this volume. They are divided into five sections. The first deals with industrial spectroscopy and its twelve papers occupy eighty-five pages. The second edition has seven papers on testing of materials and mechanical measurements, and is followed by the section on industrial control with eight contributions mainly on automatic temperature control. Section four has five papers on metrology and the final section presents nine papers on general subjects such as the electron microscope. The last paper in the book is on " New Measuring Apparatuses of the Petroleum Industry of Poland," by J. Ostaszewski (Petroleum Institute, Krosno) and describes very briefly various pieces of apparatus.

New Mexico Oil and Gas Production Data for 1946. N. Raymond Lamb and W. B. Macey. Socono, New Mexico : Bureau of Mines and Mineral Resources, 1947. Pp. 171.

This production report (Circular 16 of the Bureau) includes oil and gas production and engineering data for all pools in the State of New Mexico with the exception of Lea County.

Caprock Pool Statistical Report. N. Raymond Lamb and William B. Macey. Socono, New Mexico : Bureau of Mines and Mineral Resources, 1947.

In this publication (Circular 17 of the Bureau) are given data on production, subsurface completion, and bottom-hole pressure for wells in the Caprock pool, Chavis, and Lea Counties, New Mexico.

[The Lubricants.] N. P. Ekonomopoulos. Athens, 1946. Pp. 264.

A treatist on the origin, properties, tests, and application of lubricants written in the Greek language.

Oil for Victory. By the Editors of Look. New York : McGraw-Hill Book Co. Inc., 1946. Pp. 287. $3.50.

This is " A Look Picture Book " illustrating the vital rôle which petroleum played in the Second World War.

Statistical Methods for Research Workers. R. A. Fisher. Tenth edition, reprinted. Edinburgh : Oliver and Boyd, 1948. Pp. 354 + xv. 16*s.* 0*d.*

Faraday's Encyclopedia of Hydrocarbon Compounds. Vol. 2. C_4–C_7. J. E. Faraday. Manchester : Chemindex Ltd., 1946.

Proceedings of the Institution of Mechanical Engineers. Vol. 156, 1947. London: The Institution of Mechanical Engineers, 1948. Pp. 496 + xi.

This volume of the proceedings of the Institution of Mechanical Engineers contains a summary (3 pp.) of an informal discussion on the control of oil fires introduced by A. F. Dabell. This discussion originally took place in 1941, but publication was then prohibited.

Oil and Gas Field Development in United States. 1946. H. J. Roberts and E. J. Raisch. Austin, Texas: National Oil Scouts and Landmen's Association, 1947. Pp. 943.

Details regarding oil- and gas-field developments during 1946 in all the producing States of the U.S.A. are given. Data regarding depth, producing formations, and acreage are given for practically every field and other information includes particulars of deep wells, dry holes, wildcat wells, geophysical prospecting, etc. The book is a unique record of exploration, leasing, drilling, and production throughout the U.S.A.

German Intelligence Reports.

B.I.O.S.

1611. Major Developments in Synthetic Lubricants and Additives in Germany. Pp. 128.
1612. Fundamental Work on Combustion in Germany. Pp. 171.
1740. Cellulose-acetate, Cellulose Tripropionate, and Cellulose-acetate-Butyrate. Pp. 8.
Misc. 72. The Manufacture of Aviation Gasoline in Germany. Pp. 45.
Misc. 75. German Engine-Generator Sets. Pp. 147.
Misc. 89. The Manufacture of Tamol NNO. Pp. 5.

C.I.O.S.

Evaluation Report 16. I.G. Farbenindustrie A.G. Fuels and Lubricants Testing and Development. Pp. 4.

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Oilfield Exploration and Exploitation.

Geology.

1140. Comparative Study of Alpine and Appalachian Structures. A. E. Lombard. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 709–744.—The author's objective is stated to be the comparison of the complex system of folds and the structures of two different chains of mountains.

A direct parallelism is not to be expected, but common features exist which offer new aspects on the origin of mountain chains generally.

A description of the two systems is given, the comparison developed, and the conclusion reached that a part of the Piedmont–New England Area may be similar to the Alpine geosyncline before it was deformed by intense napping at the end of its paroxysm of shortening.

The paper is admittedly largely hypothetical, but the writer intends to introduce some new factors in the structural analysis of the two major mountain chains.

E. N. T.

1141. Geology of Benton Field, Franklin County, Illinois. J. V. Howell. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 745–766.—The Benton pool in central Franklin County, Illinois, was opened in January 1941, and nearly the whole field area was drilled by the end of that year. Oil is produced from the Tar Springs sandstone at a depth of 2000–2100 ft. Accumulation is controlled by a northward-trending anticline with limited closure, but with abrupt gradation of sand to shale at the south side. The effective sand thickness is 62 ft, and the average for the field is 42 ft. Deeper sands have not been tested.

Up to June 1947, the field had produced 18,656,892 brl. 242 producing wells had been completed, of which three had been plugged. The recovery has been just over 77,000 brl per well for each productive well drilled.

Most of the wells have been drilled through abandoned, active, and projected coal mines, and the special techniques used are discussed in this paper as well as the history of discovery, reservoir conditions, and sand conditions. E. N. T.

1142. Siletz River Volcanic Series. N.-W. Oregon. P. D. Snavely, Jr., and E. M. Baldwin. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 806–812.—The name Siletz River volcanic series is suggested for more than 3000–5000 ft of basaltic flows, flow breccia and tuff, which are exposed along the Siletz River and its tributaries in the coast range of Oregon. Included in the series are a few beds of clastic sedimentary rocks that contain a fauna correlative with the Capay shale of California. The volcanic series is correlated with the Umpqua formation of southwestern Oregon and with the lower part of the Tillamook volcanic series of northwestern Oregon. E. N. T.

1143. Petersburg Oil Pool, Hale County, Texas. R. W. Mallory. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 780–789.—The Petersburg pool is a one-well oilpool in southeast Hale County, near the southern border of the Texas Panhandle. It was discovered by the Stanolind Co. in 1947 as a result of seismographic work. The discovery well was completed in limestone of Cisco age at total depth 6992 ft, initially producing 1008 brl of oil in 18 hr. Within a year of the completion of this well, dry holes had been drilled on four sides, a granite test had disproved deeper possibilities, and the discovery well had begun to produce water. Oil accumulation in the Petersburg pool is the result of a porous limestone reservoir existing in an area of structural closure.

E. N. T.

1144. Submarine Geology of Ranger Bank, Mexico. K. O. Emery. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 790–804.—A number of bottom samples and underwater photographs from the top of a 67-fathom, flat-topped bank off Baja, California, Mexico, was studied as a wartime naval research project. The data indicate that wave action bevelled probable Jurassic metamorphic and Miocene volcanic and sedimentary rocks during a time of greater relative emergence. Subsequently the top of the bank was partly veneered by glauconite and organic sediments. Abundant phosphorite pebbles

on the surface may be derived from underlying Miocene strata. The loose sediments found on the bank are completely different from those of the truncated rocks and are also different from the muds of surrounding deeper areas. E. N. T.

1145. Submarine Sedimentary Features on Bahama Banks and their Bearing on Distribution Patterns of Lenticular Oil Sands. J. L. Rich. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 767–779.—The sea bottom for a distance of 208 miles over the Bahama Banks is visible through the water, revealing a striking pattern of bars and giant ripples that may aid in explaining the distribution pattern of lenticular oil and gas sands that seem to have been deposited some distance off-shore.

The patterns on the Bahama Banks were photographed and mapped photogrammetrically. The pattern is compared with that of the distribution of gas and oil sands in the Clinton sand area, Ohio. Interesting similarity is revealed, but the scale of the Bahama Banks features is smaller. E. N. T.

Drilling.

1146. Separate Cooling on Drilling Rigs. Anon. *Petrol. Engr*, May 1948, **19** (8), 122.—See Abstract No. 1807 (1947).

1147. Oil-base Mud in Mid-Continent Area. T. Randolph. *Oil Gas J.*, 27.5.48, **47** (4), 78.—Efficient exploitation is becoming increasingly important. Productive capacity of sands is reached by use of water and water-base muds and use of oil-base muds is an obvious solution. Reasons for the damage by water-base muds are: (1) swelling of clays in the sand; (2) jam in action or water blocking; (3) difficulty of removing the filter cake. Of these three, the first effect is believed to be most important. The use of low-water loss mud is not a solution since it appears that water loss in a hole and the A.P.I. water loss are by no means similar.

Advantages of oil-base muds are: (1) weight range from 7·8 to 16 lb/gal; (2) zero fluid loss in 1 hr A.P.I. test; (3) unaffected by salt, anhydrite cement, etc.; (4) filter cake is soluble in crude oil; (5) any fluid filtered into the pay is oil and does not damage the sand. Examples of the use of oil-base muds are given. Other uses of oil-base muds are for coring operations, killing producing wells, freeing stuck drill pipe, and in drilling heaving shale.

Use of oil-base muds requires steel or concrete pits or banks, good pipe-wipers, sawdust on derrick floor, and oil-resistant rubber parts in pumps, hoses, etc. References are appended. C. G. W.

1148. Heavy Rig Features in New Portable Rig. L. S. McCaslin, Jr. *Oil Gas J.*, 29.4.48, **46** (52), 124.—Points of interest on this rig are: (1) draw works, mud-pump, cathead's brakes, and rotary clutch controls are centred at driller's position; (2) hydraulic brake with a manual lock-out for disengaging: air clutches for high- and low-speed drum drives; (3) mast is raised by the rig's own drilling blocks; (4) compact substructure including tool box, lube-oil tank, fuel-oil tank, light plant wash-driven pump mud lines, and an air compressor.

The rig is designed for portability, being dismantled and stacked in 8 hr and erected in 12 hr. C. G. W.

1149. New Electronic Tool Determines Sticking Point of Frozen Pipe. H. David. *Oil Gas J.*, 10.6.48, **47** (6), 107.—Uses of instrument are to: (1) determine whether tubing is stuck above or below a packer or tubing hanger; (2) recover all casing possible in one length; (3) test a string of casing to measure strain or compression; (4) locate top of cement; (5) locate tool joints of internal upset in drill pipe. The instrument consists of two electromagnets in combination with a telescopic joint and an electronic device. The instrument is run to test elevation, the magnets are energized and cling to the pipe wall. The pipe is then elongated by upward strain. Any stretch moves the magnets apart and a separation of 0·001 in may be detected by the electronic device. A number of settings will give the point at which no elongation occurs.

The detecting device is sealed and insulated in a bath of liquid silicone.

Examples of the application of the instrument are described. C. G. W.

Production.

1150. A Sub-surface Flow-Rate Indicator. F. M. Carlisle. *Oil Gas J.*, 10.6.48, **47** (6), 75.—It is claimed that this instrument will indicate the following: (1) lost circulation even though there may be two or more intervals simultaneously taking fluid; (2) holes in pipe provided fluid velocities through such holes are greater than 3 ft/min; (3) relative permeability of different intervals in air-infection project; (4) relative permeability of producing intervals.

The apparatus comprises a small fluid turbine connected electrically to an indicator and counter assembly at the surface. The turbine shaft runs through a packingless seal into a chamber where a circuit interrupter or make-and-break contact is immersed in a light-weight dielectric fluid of low viscosity. The instrument is capable of measuring liquid velocities with a minimum rate of flow of 3 ft/min and has been used successfully where the gas velocity had a minimum value of 12 ft/min.

A guide or shoe prevents lodging of the tool on line tops, etc. Instrument is 3¼ in dia × 17 in long.

Field procedure and examples of flow-rate surveys are described. C. G. W.

1151. Rod Pumping. K. T. McCamman. *Oil Gas J.*, 10.6.48, **47** (6), 80.—The paper discusses the limitations of sucker-rod pumping due to rod fall and the limitations of strength.

The speed at which a unit can operate is limited by the rate at which the rods and plunger fall by gravity to the bottom of the stroke. Friction reduces this to 75% of the speed of a freely falling body giving approximately twenty-seven 6-in strokes per min or twenty 120-in s.p.m. Stresses developed in the rod string may be computed approximately by Mills formula. This gives fairly good results when imposed and reflected loads are out of phase. The usual maximum permissible rod strength is 30,000 p.s.i. and the limiting depth with such rods is 11,500 ft. With rods stressed to 40,000 p.s.i. greater production is obtained at 11,500 ft and the limiting depth for production is 15,500 ft. Pumping units and pumps are well within their limiting stresses at depths where rod strength limits production and are not a major influence on the amount of fluid being pumped.

Conclusions drawn are: (1) depths less than 1700 ft—limiting factor rate of rod fall; (2) over 1700 ft strength of sucker rods limits production. Tubing, pumping units, and pumps are not major factors. C. G. W.

1152. Allowable Transfer from High Water Withdrawal Rate Wells. G. Weber. *Oil Gas J.*, 27.5.48, **47** (4), 64.—Shut-down of over 200 high-water-oil-ratio producers and the transfer of their allowable to other field leases has reduced water production in East Texas by 50,000 brl. Withdrawals of 25 million brl of water will be avoided in the next three years.

This measure was adopted because water production was rising faster than facilities for treating and injecting water could be installed. The measure is a temporary one designed to allow operators to expand their injection facilities to cope with the increased water production. C. G. W.

Oilfield Development.

1153. Petroleum Industry in Canada. J. B. Phillips. *Petroleum*, Mar. 1948, **11**, 53.—A description of progress and present status of the Canadian oil industry. Production is now 8–10 million brl a year.

The cumulative production of crude up to 1945 was 105,274,000 brl, and Canada is credited with additional proved reserves of about 150 million brl. The probable ultimate resources are estimated at about 10 billion brl.

These estimates take little account of the vast quantities of oil in the bituminous sands of Athabaska, Northern Alberta. Estimates of 100–250 billion brl have been made for these deposits.

The Turner Valley field in Alberta is the only important oilfield discovered to date; it reached its peak production of 10,136,296 brl in 1942, declining to only 6 million brl in 1946.

The oil from this field is an intermediate-base, waxy crude, yielding about 40% of gasoline and naphtha fractions; sulphur is about 0·5%.

A new field at Leduc, Alberta, is being developed; recent estimates place the ultimate potential at about 350 million brl.

Production at Norman Wells, North-West Territories, is increasing sufficiently to offset to some extent the decline in the Turner Valley production.

The Athabaska Tar Sands are saturated with heavy asphaltic petroleum (sp. gr. 0·995), the oil content averaging about 10%. Methods for commercially exploiting the deposit have been under investigation for thirty years. Analyses indicate that the following fractions could be obtained: aviation gasoline 23%; motor gasoline 17%; light burning oils 19%; lubricating oils 36%; asphalt, etc., 5%.

If this oil could be extracted economically, Alberta would become one of the world's major oil areas.

Refinery locations and statistics are presented. F. W. H. M.

1154. Oil in England. Anon. *Petroleum*, May 1948, **11**, 101.—The two present producing areas in England are at Formby in West Lancashire and Eakring in Nottinghamshire, the latter being the most important. The development of these fields is described.

An intensive gravimeter survey from the Mendips to the Essex coast is being carried out by the D'Arcy Exploration Co. to select promising areas for further detailed survey.

High-grade lubricating oil can be made from Eakring crude as well as high-octane motor and aviation gasolines.

112,000 tons of crude were produced in 1943—the peak year. The Eakring field is declining steadily, producing now only about 45,000 tons a year.

The high wax content of the crude causes production difficulties and electrical heating is necessary to enable the oil to flow.

Extension of the search for oil in England is discussed. F. W. H. M.

1155. Recent Developments in the Polish Oil Industry. F. Wirth. *Petroleum*, Apr. 1948, **11**, 88.—A new natural gas field in the Deboweic-Simoradz area in the Piedmont Zone of the Western Carpathians was an important discovery of the Polish Oil Industry in 1947.

Details of the various wells in this field are given and the Failing drilling rig used is described.

A synthetic petroleum industry is being planned to operate if and when the gas resources become adequate.

Twenty-three test wells in other sectors have been drilled—a five-fold increase over 1946.

Production figures for 1947 are given. The output of crude in June 1947 was 11,084 metric tons, the highest since the end of the war. F. W. H. M.

Transport and Storage.

1156. Zinc Anode Protection Installed During Pipeline Construction. O. C. Roddey. *Oil Gas J.*, 22.4.48, **46** (51), 87–88.—Interstate Natural Gas Co. installed cathodic protection on its pipeline system in Louisiana, using zinc as the galvanic-anode material. Anodes were placed at various intervals, using the distributed-anode method with single rods at each location. The line, completed in March 1946, is 83·5 miles in length.

For pipelines which are to receive electrical drainage, protective coatings must have good electrical insulation, low moisture absorption, and be inert to soil chemicals. Interstate used pipe-enamels, protected by a double reinforcing wrapper to act as a shield against stones, clay, and soil stresses. The enamel was applied on the field, using a thin layer of primer. A coat of Somastic was applied on 13·8 miles through the Atchafalaya floodway.

Experiments carried out by Interstate in 1932 showed that currents as low as 1 amp would afford protection for a mile of 22-in pipe. The sacrificial anode is easily adaptable to this type of installation, and zinc was chosen because of its high current-output efficiency. Details of anodes and their installation are given.

A corrosion survey was carried out, and penetration rates, corrosion activity, and location of "hot spots" were determined on more than 60% of the line before construction.

Anode distribution is discussed, a separation of 300 ft being considered the maximum, and the article is illustrated by tables and diagrams. Two references are given. W. M. H.

1157. Rust Prevention in Products Pipelines. E. W. Unruh and F. M. Watkins. *Oil Gas J.*, 17.6.48, **47** (7), 63.—Properties of a new rust inhibitor, Sinclair RD-119, are described and its laboratory rust tests discussed. The concentration at which this inhibitor is effective is approx 0·006–0·007% vol.

Experience has shown that complete protection against rust formation can be obtained with lower concentrations of the new inhibitor when it is used in a moving stream than when it is used in a static system.

RD-119 is being used in all operating Sinclair products pipelines. Details of the composition of the inhibitor are not disclosed. G. A. C.

1158. Vapour Output to Heat Input Ratio for Petroleum Storage Tanks Exposed to Fire. M. L. Arnold and G. H. Horne. *Petrol. Engr*, Mar. 1948, **19** (6), 220.—If a storage tank is exposed to fire, its contents will be made to boil, and so provision must be made to release the vapours.

Generalized factors are derived for selecting the tank vents or relief valves. For atmospheric storage tanks the empirical formula $\frac{Q'}{H'} = 50 + \frac{N}{30}$ is derived where Q' = air-equivalent venting rate, M cu. ft/hr, H' = heat-input rate M.M. B.Th.U./hr, N = boiling point °F, and M is the mol. wt. The limitations of the relationship are discussed.

For pressure storage a formula $\frac{A}{H'} = \frac{60}{P} + 0{\cdot}1$ is derived where A = relief-valve nozzle area sq. in, H' = heat input rate M.M. B.Th.U./hr, and P = pressure in the tank in p.s.i. Both these relationships gave results agreeing well with values calculated from thermodynamic data. G. K. A.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1159. Daily Capacity of Gulf Coast's 73 Gas Processing Plants more than 4½ million gallons. D. M. Duff. *Oil Gas J.*, 24.6.48, **47** (8), 156.—Tables are given showing location and throughput of the seventy-three gas-processing plants of all types on the Gulf Coast; also of new plants and expansions planned.

The established plants produce over 4½ million gal daily of liquid hydrocarbons which is more than 20% of total capacity for all such plants in U.S.A. G. A. C.

1160. Gulf Coast Refining Operations. D. M. Duff. *Oil Gas. J.*, 24.6.48, **47** (8), 174.—A review is given of the Gulf Coast region refining capacity, and of expansions.

Two new plants of major size, and a high level of winter operations with yields adjusted to manufacture maximum quantities of mid-distillate burning oils are developments indicated.

Tables show location of plants and summarize refining data. G. A. C.

1161. The Manchester Oil Refinery. Anon. *Petroleum*, Mar. 1948, **11**, 62; Apr. 1948, **11**, 84; May 1948, **11**, 110.—Photographs and descriptions of various parts of the refinery. F. W. H. M.

1162. Jefferson Chemical Enters Petrochemical Field. J. V. Hightower. *Chem. Eng.*, 1948, **55** (4), 112–113.—A short account is given of the new Jefferson Chemical Co. plant at Port Neches, Texas. Main products at present include ethylene oxide and ethylene glycol, from petroleum refinery gases obtained locally, using chlorine and

lime as the principal other raw materials. Other products envisaged include ethylene polyglycols, ethylene dichloride, and aromatics. R. T. W. H.

1163. Electrical Equipment for Petroleum Refining. B. M. Mills. *Petrol. Engr*, May 1948, **19** (8), 248.—Increased refinery electrification has placed new emphasis on safety precautions, and the increasing electrical loads have presented problems. The article discusses the location of control rooms, etc., with regard to hazards, and suggests methods to be used in hazardous areas. Thus no high-voltage starters with an interrupting capacity of over 50,000 kVA should be used in hazardous areas, either the starters should be placed in a suitably located control room or low-voltage (440 volts) motors should be used. The classification of locations according to the National Electric Code is given. G. K. A.

1164. High Pressure Power Station at Whiting. D. A. Monro and A. T. Milbrook. *Petrol. Engr*, Apr. 1948, **19** (7), 166.—The Standard Oil Co.'s Whiting refinery, placed in operation in 1928, had power-station conditions of 400 p.s.i., 650° F. Expansion and trend in refinery operation now resulted in large extra requirements in electrical energy with little further requirement in process steam. Two solutions were possible, installation of condensing turbo-generators operating at an initial pressure of 400 p.s.i. or the installation of units to top the existing cycle with another in which the turbines would exhaust at 400 p.s.i. The latter alternative was chosen, the turbine initial conditions being 1250 p.s.i., 900° F. The features of the boilers are: (1) a continuous output of 300,000 lb/hr at a pressure of 1350 p.s.i. at the superheater outlet; (2) the design for the use of pulverized coal, oil, or refinery gas firing; (3) two separate heat-absorbing sections each with its own separator, this system results in a lower concentration of silica vapour in the steam. 100% make-up water is used, the water-treatment plant consisting of three lime–soda sedimentation tanks and two phosphate sedimentation tanks. The final design provides for five 10,000 kW topping turbo-generators. A flow diagram and lay-out details are given. G. K. A.

1165. The "Semi-Works." H. Seymour. *Petroleum*, Mar. 1948, **11**, 58.—The difficulties involved in putting a laboratory process into operation on a commercial scale may be solved by installing a half-way house between laboratory and large-scale plant.

This "Semi-Works" is discussed and examples given of its successful application. F. W. H. M.

1166. Condensation and Subcooling Inside an Inclined Tube. J. B. Tepe and A. C. Mueller. *Chem. Eng. Progr.*, 1947, **43** (5), 267–278.—Results of investigations on the effects of angle-of-inclination flow rate and temperature difference on the rates of condensation of benzene vapour and methanol vapour and on the rates of sub-cooling of the liquid condensates inside a single water-cooled tube are presented.

Tests carried out with a copper tube $\frac{7}{8}$ in. in diameter and 3 ft long, inclined at angles of 0°, 15°, and 90° to the horizontal, showed only a slight effect on condensation coefficients with variations in the angle of inclination. Condensate cooling coefficients, measured in separate runs, decreased markedly with reduction in the angle of inclination. Increased vapour velocity at all inclinations resulted in increased condensation coefficients, both for benzene and methanol, the increase being greater for benzene. Condensate cooling coefficients increased with increasing flow rate at all inclinations, becoming less pronounced with decrease in the angle of inclination. J. G. H.

1167. Removal of Organic Deposits from Tubular Heat Exchangers. K. C. Edson and J. S. Powell. *Oil Gas J.*, 3.6.48, **47** (5), 71.—An oven for removal of organic deposits from tubular heat exchangers by burning was constructed so that temperature, oxygen content in the gas, and gas circulation were controlled.

Plugged tubes are mechanically brushed or drilled before treatment. Firing is gradually increased to optimum temperature (550° F for admiralty-tube bundles and 800° F for carbon-steel exchangers). The small amount of residue after treatment is removed by a stream of air or water.

Six figures illustrate the article. G. A. C.

1168. Method for Designing Packed Columns. M. J. Simon and M. A. G. Rau. *Industr. Engng Chem.*, 1948, **40**, 93.—The authors point out the inadequacy of using overall values of transfer coefficients and H.T.U.'s, and by assuming that the slope of the equilibrium curve is constant over short intervals of the curve, they derive an equation (based upon mass-transfer from one phase to the other, across interfacial films) suitable for designing a packed column. J. D. T.

1169. Decomposition Hazard of Vacuum Stills. K. C. D. Hickman and N. D. Embree. *Industr. Engng Chem.*, 1948, **40**, 135.—The authors indicate a scheme for determining the thermal hazard to which labile substances are exposed in different types of distillation equipment. The following relationships are given :—

F = hazard per plate of fractionation.
$= D/P$
D = decomposition hazard = time (seconds) × pressure (microns)
P = number theoretical plates.
Dh = index of hazard $= \log D$
Fh = plate hazard index $= \log F$
$= Dh - \log P$.

Values of Dh and Fh are given for different stills. J. D. T.

1170. Maintenance of Cooling Towers. J. G. De Flon. *Petrol. Engr*, May 1948, **19** (8), 200.—See Abstract No. 742 [1948].

1171. Fuel and Steam Economy. M. Berkley. *Petrol. Engr*, May 1948, **19** (8), 221.—The author discusses the instruments and controls available to aid in reducing steam waste and conserving fuel in an average-sized industrial steam-boiler plant. Fundamental problems are: (1) steam pressure; (2) combustion; (3) load distribution; and (4) steam distribution.

Combustion should be controlled to maintain steam pressure, produce complete combustion, and reduce stack loss. The use of a carbon-dioxide meter and draft indicator will facilitate this. A fuel-gas-temperature recorder will also indicate presence of excess air.

Steam-flow meters in the steam leads from each boiler will allow control of boiler operations to allow each to operate efficiently.

The automatic types of combustion control are discussed, also methods of metering. G. K. A.

1172. Sound Waves now Harnessed for Industry. R. W. Porter. *Chem. Eng.*, 1948, **55** (3), 100.—Large-scale application of high-frequency sound waves in industry has been developed. A high sound-wave intensity can be achieved with a new sound generator, developed by the Ultrasonic Corpn.

Its main use to date has been in aerosol agglomeration. The recovery of smoke, dusts, and mists can be effected by this means.

The generator is essentially a high-speed air siren, driven by a variable-speed turbine. Frequency is governed by the speed of rotation, and intensity by the amount of air admitted to the generator.

In agglomerator towers, the sound generator is placed at the top and the sound vibrations directed downwards. The first industrial application was developed for the manufacture of furnace black from natural gas, and gave a 96% recovery. The intense sound waves give the particles a wide velocity distribution, leading to more collisions, and thus to agglomeration. Particles of dimensions 15–100 microns are the largest to be affected in this way. Subsequent separation by a cyclone separator is greatly facilitated. Other projected applications include soda recovery from stack gases, salt-cake recovery, sulphuric-acid mist precipitation, dust recovery from flue gases, and dispersion of natural fog; as an aid to spray drying, together with certain applications in the liquid–solid field. R. T. W. H.

Distillation.

1173. Clarification Needed for Distillation Terms. M. G. Larian. *Chem. Eng.*, 1948, **55** (3), 116–118.—The author suggests that a distinction be made between a theoretical

contact unit—*i.e.*, the region within the sphere of action of a single bubble cap, or a number of such caps in parallel (but not in series) to the liquid flow across a plate—to a theoretical plate, which will consist of one or more theoretical contact units, determined by the mechanical arrangement of the plate.

Similarly, separate efficiencies for the "unit" and the "plate" would be conceived, both expressible by an equation similar to the Murphree expression.

By this means, plate efficiencies of more than 100% would be avoided, whilst a more accurate picture of the real efficiency of the plant is given. R. T. W. H.

1174. Plate Efficiencies of Benzene–Toluene–Xylene Systems in Distillation. M. Nord. *Trans. Amer. Inst. Chem. Engr*, 1946, **42**, 863–881.—Experimental data are presented on plate efficiencies of benzene–toluene, benzene–*m*-xylene, toluene–*m*-xylene, and benzene–toluene *m*-xylene as an illustration of the effect of addition of a third component to a two-component system. Results obtained are compared with those obtained by theoretical calculations, and the effects of concentration diffusion efficiencies and entrainment on plate efficiency are discussed. J. G. H.

1175. Multistage Separation Processes. M. Benedict. *Chem. Eng. Progr.*, 1947, **43** (2), 41–60.—Recent separation processes are classified as differential or stage processes, separate-stage or column processes, potentially reversible, partially reversible, or irreversible processes. Examples of applications are given, together with comparisons with ordinary distillation and other familiar separation processes and an estimate of their probable future fields of usefulness. The theory and basic constants of each process, such as separation factor and energy consumption, are discussed and advantages and disadvantages enumerated. Comparative data are given on the use of chemical exchange, thermal diffusion, gaseous diffusion, and the countercurrent gas centrifuge, the last being specially suitable for isotope separation. J. G. H.

1176. Reduction of Topped Crude by Vacuum Flashing. C. J. Helmers, P. H. Johnson, and K. L. Mills. *Oil Gas J.*, 17.6.48, **47** (7), 85.—It is shown how a small laboratory unit can be utilized in developing flash curves and physical characteristics of both the overhead oil and vacuum tar.

The information, together with yield data obtained from flashing the heavy oils, can be used in making preliminary economic comparisons, and in predicting the approximate yield which may be expected from the plant-scale vacuum unit.

Sixteen figures illustrate the article. G. A. C.

Absorption and Adsorption.

1177. Activated Carbon. P. H. Conrouleau and R. E. Benson. *Chem. Eng.*, 1948, **55** (3), 112–115.—The manufacture of activated carbon requires two steps—carbonization and activation. For the carbonization process, suitable materials include peats and certain bituminous coals, together with cocoanut shells and certain woods.

A recent activation process involves the mixing of pulverized charcoal with a K_2CO_3–KCNS solution at 120° C, followed by pulverizing, treating the material with wood tar, and extruding into rods, which are subsequently broken into pellets. These pellets are finally activated in kilns at 900–1000° C.

The capacity of absorption is dependent on several variables, including the type of vapour, vapour concentration, temperature, number and selectivity of vapours, and the contact time. Selective adsorption, when using a mixture of vapours, will occur, enabling a selective adsorption process ("hypersorption") to take place.

The use of activated carbon in solvent recovery is described in detail. The plant process including the collection of vapours, precooling, and prefiltration (to avoid poisoning of the adsorbent), and the authors describe the design of adsorbers and regeneration plant and equipment. Control systems and process economies are discussed. 99% recovery may be achieved in many cases.

Further applications include the recovery of benzol, carbon disulphide, trichloroethylene and ethylene dichloride, ketones, carbon tetrachloride and solvent naphtha, xylene, toluene and acetates, alcohols and esters, and various hydrocarbons.

R. T. W. H.

1178. Avoiding Destructive Velocity through Adsorbent Beds. E. Ledoux. *Chem. Eng.*, 1948, **55** (3), 118–119.—Excessively high gas velocities in adsorbent beds produce motion of the particles in the upper layers of the bed. This motion leads to abrasion and size reduction, eventually to a degree where entrainment of the smallest particles is permitted. These processes are demonstrated by sketches of the bed under various conditions and arrangements. The author then proceeds to evolve a dimensionless equation

$$G^2/d_g d_a D g = K$$

where G is the mass velocity
d_g „ „ gas density
D „ „ average particle diameter
d_a „ „ the apparent density of the bed.

Experimental work has evaluated the constant K at a value of 0·0167. This expression enables the maximum safe gas velocity to be determined, when designing adsorbent systems for gases, under various conditions of temperature and pressure.

R. T. W. H.

Solvent Extraction and Dewaxing.

1179. SO_2 Extraction Unit Completed at General Petroleum's Torrance Refinery. S. W. Dickey. *Oil Gas J.*, 27.5.48, **47** (4), 67.—The SO_2 extraction (Edeleanu) plant at the Torrance California Refinery of General Petroleum Corpn is described.

50-cetane diesel oil is produced at a charge rate of 5000 b.d. with an SO_2 contact rate of 125% or 6250 b.d.

Essential features include a treating tower for contact of oil and SO_2-evaporator systems for SO_2 recovery from raffinate and extract streams, a filter and deaerator system, and a refrigerator system. Tables give operating data, yields, and properties of products. G. A. C.

1180. Effect of Solvent Composition and Primary Solvent Dilution on Dewaxing Filter Rates and Wax Oil Contents. E. J. Reeves and I. E. Pattillo. *Refiner*, Mar. 1948, **27**, 110.—Two types of raffinate were used in this series of experiments, one from a Mid-Continent distillate with a 73-sec S.U. viscosity at 130° F and the other from a Mid-Continent residuum with a 95-sec S.U. viscosity at 210° F. The solvent used was a mixture of methyl ethyl ketone and toluene, the percentage of toluene being varied from 0 to 100% in different experiments.

The results show that maximum rates of filtration are obtained with both types of oil when the percentage of ketone is a maximum, this maximum being controlled by the oil-phase separation temperatures for the particular stock. The minimum slack-wax oil contents are obtained when the waxy oil is chilled to the dewaxing temperature before addition of solvent. For neutral oils it is shown that there is an optimum balance between solvent power of the dewaxing solvent and the ketone content which gives the maximum oil yield and dewaxed oil production rate. The solvent composition does not affect the ultimate yield of a fixed-pour-point oil, provided that oil-phase separation does not occur. H. A. C.

1181. Furfural in Refining and Purification. H. Seymour. *Petroleum*, May 1948, **11**, 104.—The application of furfural to the solvent-refining of lubricants is discussed. The efficiency of the process is attested by the fact that losses of furfural in refinery practice normally range from 0·03 to 0·06% of the furfural used per cycle.

The general advantages of the use of furfural are described.

An account of extractive distillation using furfural, with particular reference to butadiene production, is given.

The influence of the water content of the furfural is mentioned. F. W. H. M.

Cracking.

1182. Catalytic Cracking of Heavy Distillate. C. H. Viland and J. Seth. *Oil Gas J.*, 20.5.48, **47** (3), 187.—Catalytic cracking of unusually heavy distillate at the Avon, California, refinery of Tide Water Associated Co. is discussed. The plant was originally constructed for production of aviation gasoline.

The feed requires large amounts of catalyst, 1 lb of Filtrol natural catalyst/brl of oil charged. "Low-level" operation resulted in decreased coke and gas yields for a given level of conversion.

It is concluded that catalytic cracking of extremely heavy distillate-charging stocks are feasible, safe, and economically desirable. Tables show feed-stock characteristics, typical monthly average yields, and properties of catalytic gas oils. G. A. C.

1183. Sarnia Catalytic Pilot Plant. H. G. Jarman. *Petroleum*, Mar. 1948, **11**, 60.—Description of a pilot plant operating on 3 gal of oil an hour, in which refinery operations can be reproduced in miniature to test new improvements in the "Suspensoid" catalytic-cracking process. F. W. H. M.

1184. Casper Unit Model of Small Refinery Design. Anon. *Petrol. Engr*, Feb. 1948, **19** (5), 182.—The article describes the features of a small fluid catalytic cracker of 4000 b.d. capacity. The features of the design are: (1) a new "balanced-pressure" design resulting in the reactor and regenerator being supported at the same levels affecting an overall reduction of height and simplification of piping; (2) an oblong design with all big vessels on the outside enables each vessel to be erected independently of the others; (3) a new cylindrical electrical precipitator to operate at high pressure; (4) the fractionator serving as rectifier, desuperheater, and slurry settler; (5) an outside stripper separating oil from catalyst and preventing oil from entering the regenerator. G. K. A.

1185. Fluid Bed Catalytic Cracking Plant. R. P. Trainer, N. W. Alexander, and F. Kunreuther. *Industr. Engng Chem.*, 1948, **40**, 175.—A fluid-bed catalytic-cracking plant (capacity 3 b.d.) is described. Layout and instrumentation are discussed, together with starting-up and sampling procedures. Special mechanical aspects of the plant, together with analytical requirements, are also included in the paper. J. D. T.

Hydrogenation.

1186. Development of the Technology of Hydrogenating Solid Fuels and their By-products. L. Thibaut. *Chim. et Ind.*, 1948, **59**, 548–551.—A description of the process developed by the French Synthetic Gasoline Co. for the hydrogenation of solid fuels. Hydrogenation and fractionation of the resultant products are carried out within the same system so that the heavier products are retained till they have been fully reduced, whilst the more volatile fractions are removed immediately after formation. A temperature gradient of 300–500° C is maintained in the hydrogenation vessel, and products are removed as soon as they are formed. The middle-oil fraction produced (which also serves as carrier for the solid charge) undergoes further immediate catalytic hydrogenation to gasoline in a second reaction chamber. Catalyst used is largely iron sulphide on an activated charcoal base with promoters ($\gtrsim 3\%$) consisting of cyanides and sulphocyanides of group V metals (chiefly Fe, Cr, Al). On hydrogenating the middle oil to gasoline (77 O.N.) a conversion of 95% per pass is attainable. Lubricating oils can be obtained from heavier fractions. The system has operated on a pilot plant (20 tons/day) and it is claimed that the use of a single closed circuit enables considerable economies to be effected in operating and standing charges. V. B.

Isomerization.

1187. Butane Isomerization, U.O.P. Process. J. A. Chenicek, J. O. Iverson, R. E. Sutherland, and P. C. Weinert. *Chem. Eng. Progr.*, May 1947, **43** (5), 210–218.—A new isomerization process for the production of *iso*butane from normal butane, also adaptable for improving the octane number of pentane and hexane fractions employs, as catalyst, aluminium chloride deposited on inert packing. Activity of the catalyst is maintained by continuous introduction of aluminium chloride; recovery being effected by recycling of the reactor effluent. Problems encountered, including the design of equipment for the fractionation of mixtures of aluminium chloride, hydrogen chloride, and hydrocarbons, the selection of suitable pumps and variations in operating conditions, are discussed. J. G. H.

Chemical and Physical Refining.

1188. Recent Developments in Refining in Canada. J. B. Phillips. *Petroleum*, June 1948, **11**, 125.—The major developments in refining practice in Canada during the past twelve years have been chiefly in the production of high-octane gasolines. Important advances have been made in the recovery of absorption gasoline from Turner Valley gases and in recycling of surplus gases back to the wells to extend the life of the field.

The phosphoric acid (Universal) polymerization process was installed at three Montreal refineries; the process is briefly described.

Two alkylate plants are in production.

The polyform process is used at the Clarkson refinery where high-grade lubricating oils are also produced by solvent extraction and dewaxing and catalytic-contact filtration.

In 1947 the Imperial Oil Co. began to erect a fluid catalytic-cracking plant.

The alkylation, polyform, and fluid catalytic-cracking processes are described in some detail, and flow-sheets given with locations of the various refineries using these processes.

Lubricating oils are mainly refined by furfural extraction followed by methyl-ethyl-ketone dewaxing and catalytic-contact filtration. The process is described.

F. W. H. M.

1189. Incineration Solves a Waste Disposal Problem. Anon. *Chem. Eng.*, 1948, **55** (3), 110–111.—The disposal of an alkaline mother liquor containing organic polysulphides presents a difficult problem. Incineration, accomplished by spray injection of the liquor into a furnace fired by ordinary factory waste, provided a neat solution.

R. T. W. H.

Special Processes.

1190. Jefferson Chemical Plant Now Under Full Operation at Port Neches. A. L. Foster. *Oil Gas J.*, 6.5.48, **47** (1), 100.—This large plant, occupying 1100 acres, is now in full production manufacturing ethylene glycol, ethylene oxide, ethylene dichloride, and other hydrocarbon chemicals. There are three main-process units. Refinery gases are purified with ethanolamine, combined with cracked gases from cracking heaters, compressed, and fractionated. Refrigeration is necessary to recover the light components, and liquid propane and ethane are used as refrigerants. Three main streams are produced: purified ethylene; distillate stream high in aromatics; hydrocarbon polymer stream.

A specially designed unit produces ethylene oxide, ethylene glycol, polyethylene glycol, and crude ethylene dichloride, which is purified by drying and redistillation in a separate unit.

Heaters, compressors, water system, chlorine storage, power, fire protection, transport, and the laboratory wing are briefly described. W. M. H.

1191. Chromium Oxide as a Catalyst Promotor for Fischer-Tropsch Synthesis at Medium Pressures. J. C. Ghosh and N. G. Basak. *Petroleum*, June 1948, **11**, 131.—By the incorporation of Cr_2O_3 and Ce_2O_3 with a Co–Cu–ThO_2–kieselguhr catalyst, the synthesis of hydrocarbons by the Fischer-Tropsch method may be economically improved.

The catalyst, besides being reducible at lower temperatures (237–240° C), functions steadily and yields with cheap water gas at 5 atm pressure and 206° C, 160 g of hydrocarbons per cu. m. of water gas, with a space velocity of 570–600 cc/hr/cc of catalyst in a single-stage operation.

Details of the experimental procedure and results obtained are presented. The catalyst (A) used had the following composition :—

Co	34·14%
Cu	4·085%
ThO_2	2·233%
Ce_2O_3	0·2385%
Cr_2O_3	4·596%
Kieselguhr	54·70%

The effect of the Cr_2O_3 was found by comparing the hydrocarbon yield using the catalyst (A) above, with that obtained using a catalyst (B) of the same composition except that the Cr_2O_3 was replaced by an equal percentage of kieselguhr.

The yields were approximately as 1·5 : 1. F. W. H. M.

1192. Lubricant Synthesis. M. R. Dupas. *Bull. Assoc. franç. Tech. Pétrol.*, 1948, (69), 1–16.—After a brief review of the chief methods for lubricating-oil synthesis, a description (with flow sheet) is given of the process used at the Standard-Kuhlmann plant at Estaque. Lubricating oil is produced by a Friedel–Craft condensation of benzene with dichlorethane and a Fischer-Tropsch gas oil (180–320° C) chlorinated to a Cl content of 22–24%. Production is effected continuously in three steel vessels in the first of which (at 80° C) benzene, dichlorethane, and Al powder are mixed. The chlorinated gas oil is added in the second stage (at 100° C), and the reaction is concluded in the third vessel (at 120° C). Flow through the plant takes 6 hr. The supernatant oil is separated from the $AlCl_3$ residue, neutralized with sodium-carbonate solution, and the excess benzene removed by distillation. Following a clay treatment to eliminate traces of $AlCl_3$ the product is vacuum distilled yielding two side streams (transformer and light engine oils) and a residual bright stock; gas oil is removed overhead and recycled. A further quantity of secondary oil, together with benzene and gas oil, is recovered by hydrolysis of the $AlCl_3$ residue. The yields (as % on the hydrocarbon charge) are: primary oil 45%, secondary oil 10%, recycle 27%, and loss 18%. Plant capacity (not at present being attained) is 25 tons/day. The viscous oils (35–330 cs at 50° C) obtained have high density (0·942–0·950), good V.I. (74–80) and low pour (− 12 to − 21° C). Their highly aromatic character gives them a marked solvent action, engine tests show favourable results, especially as regards engine cleanliness. V. B.

1193. Petrochemical Expansion Continuing in Petrochemical Industry. Anon. *Oil Gas J.*, 24.6.48, **47** (8), 237.—A review is given of the principal Gulf Coast petrochemical plants, including synthetic-rubber units.

The view is given that the synthetic-rubber industry has an assured future because of the need for U.S. national security.

Two tables list locations and capacities of the plants. G. A. C.

1194. Commercial Scale Manufacture of Allyl Chloride and Allyl Alcohol from Propylene. A. W. Fairbairn, H. A. Cheney, and A. J. Cherniavsky. *Chem. Eng. Prog.*, 1947, **43** (6), 280–290.—The production of allyl chloride by the high-temperature chlorination of propylene and the production of allyl alcohol by the hydrolysis of allyl chloride with aqueous sodium hydroxide are described with the aid of flowsheets. Both processes are continuous. Results of variations in reaction temperature and feed ratio in the first process are discussed, together with variations in alkalinity, dilution, temperature, and residence time in the final process. Data are presented on materials of construction and the solution of corrosion problems. J. G. H.

1195. Developments in Petroleum Chemistry. F. W. Miller. *Petrol. Engr*, Mar. 1948, **19** (6), 111.—The author discusses the change in the petroleum industry with the increasing supply and demand for chemicals and quotes figures for the expected production in 1948 of the common chemicals such as methanol 110 million gal; formaldehyde 540,000,000 lb; acetone 350,000,000 lb; and other chemicals, the majority of which are made from natural gas. G. K. A.

1196. Chemical Engineering Unit Operations Review. Anon. *Industr. Engng Chem.*, 1948, **40**, 5–56.—This is Section III of the annual series "Unit Operations Review," sections I and II appearing in the issues of January 1946 and January 1947 respectively. The following subjects are discussed:—

Absorption and humidification; centrifugation; crushing and grinding; crystallization; high-temperature distillation; high-vacuum distillation; drying; evaporation; filtration; flotation; fluid dynamics; heat transfer; ion exchange; materials handling; mixing; sedimentation and hydraulic classification; solvent extraction.

J. D. T.

Safety Precautions.

1197. Pouring Temperatures for Liquids. W. L. Nelson. *Oil Gas J.*, 20.5.48, **47** (3), 239.—In No. 197 of the Refiners Notebook series, pouring temperatures for hot liquids are suggested, based on the temperature at which the material will exert a vapour pressure of 300–400 mm.

Products dealt with range from natural gasolines to asphalts. G. A. C.

1198. Safety and the Chemical Engineer. C. F. Montross. *Petrol. Engr*, Jan. 1948, **19** (4), 207.—The contribution of the chemical engineer to safety in research and development, design, and operation is discussed together with points that should be considered. G. K. A.

1199. Free Radicals in Flames. P. Laffitte. *Rev. Inst. Franç. Pétrole.* 1948, **3**, 27–41.—A review is given of methods for the detection of free radicals in flames, which has been chiefly accomplished by spectroscopical and, more recently, mass-spectrometer methods. Both emission and absorption spectra have been used, but chiefly the former. Detection of diatomic radicals is fairly certain, but that of triatomic is difficult and, up to the present, only one (HCO) has been identified with reasonable certitude. This difficulty can be overcome by the mass spectrometer. Results obtained in the study of flames of hydrogen, hydrocarbons (both normal and "cold" flames), carbon monoxide, and of compounds containing nitrogen, halogens, sulphur, and phosphorus are summarized. The data so far reported have been qualitative, and it is considered that the time has come for the investigations to be pursued on a quantitative basis. Forty-five references. V. B.

Products.

Chemistry and Physics.

1200. Furan Chemistry. Anon. *Industr. Engng Chem.*, 1948, **40**, 200–236.—A general discussion. Topics dealt with include: industrial development of furfural; furfural formation and behaviour; catalytic hydrogenation of furan compounds; chemical intermediates from furfural; furfural as a selective solvent in petroleum refining; furans in vegetable-oil refining; furan resins. J. D. T.

1201. Reaction of Cyanogen and Related Compounds with Butadiene. G. J. Janz and P. J. Hawkins. *Nature*, 1948, **162** (4105), 28.—The formation of substituted pyridines from butadiene and RCN, where R = H, CH_3, and C_6H_5, occurs at 600° C and atmospheric pressure in an unpacked quartz reaction vessel, using a continuous-flow technique. The contact times and yields of product are given, together with the theoretical free-energy changes at temperatures from 400° to 1000° C. H. C. E.

1202. Energy of the Central C–C Bond in Diphenyl. M. Szwarc. *Nature*, 1948, **161**, 890.—Calculation of the C–C bond energy in diphenyl from the heats of formation of diphenyl and benzene gives a value of 110 k.cal, which is 25 k.cal greater than the C–C bond energy in ethane. The length of the bond is therefore 1·43–1·45 Å.

The reactions of methyl and phenyl radicals in aliphatic and aromatic hydrocarbons indicate that the energy of the diphenyl C–C bond must be >106 k.cal. An X-ray method gives this bond length as 1·48 Å with an accuracy of 10%. An electron-diffraction method also gives a value of 1·48 Å, which, however, is thought to be too high because the phenyl hexagons are more irregular than was assumed in the computation. H. C. E.

1203. Synthesis of Fluoranthene Derivatives. E. Bergmann. *Nature*, 1948, **161**, 889.—It has been suggested that the formation of aromatic hydrocarbons in high-temperature cracking of petroleum fractions is due to diene synthesis between butadiene and olefins. In particular fluoranthene (I) may be formed from acenaphthylene (II) and butadiene *via* a hydrogenated fluoranthene derivative. This has been confirmed by identification of phenyl tetra-hydro derivatives of I formed by the reaction of II

with various phenyl derivatives of butadiene at 160–200° C. Di*cyclo*hexenyl and scorbic acid also react with II; in the former case partial dehydrogenation occurs, and in the latter case the carboxyl group is split off. It is evident that II contains a very reactive double bond which makes it prone to polymerization and copolymerization reactions. H. C. E.

1204. Depolarized Petroleum Naphthas. C. Allen. *Industr. Engng Chem.*, 1948, **40**, 124.—The author discusses the molecular structures of several classes of organic compounds, and attempts to correlate these with certain physical properties, *e.g.*, dipole moment and dielectric constant. Petroleum constituents have been divided into three classes: polar, polarizable, and non-polar. The properties of each type are enumerated, and industrial applications of depolarized naphtha are indicated. J. D. T.

1205. Thermodynamics of Non-electrolyte Solutions. O. Redlich and A. T. Kister. *Industr. Engng Chem.*, 1948, **40**, 341.—The authors point out that the accurate solution of distillation and extraction problems demands an efficient method of expressing thermodynamic data of non-electrolyte systems. The present paper presents experimental vapour–liquid equilibrium data as functions of temperature (pressure remaining constant). J. D. T.

1206. Algebraic Representation of Thermodynamic Properties and the Classification of Solutions. O. Redlich and A. T. Kister. *Industr. Engng Chem.*, 1948, **40**, 345.—A method is developed for the representation of thermodynamic properties of systems of two or more components. This method aims at eliminating inconsistencies in experimental results, without imposing arbitrary conditions, and enables distinction to be made between various types of systems. J. D. T.

1207. Viscosity and Shear Elasticity Measurements of Liquids by Means of Shear Vibrating Crystals. W. P. Mason. *J. Coll. Sci.*, 1948, **3**, 147–162.—Viscous and shear waves set up in certain crystals provide a means of measuring the viscosity and shear elasticity of liquids in which the crystals are immersed. A short mathematical section is followed by a description of methods of making torsional crystals of quartz and ammonium dihydrogen phosphate. The experimental method of measuring viscosities is described, and some experimental results are given. Liquids which have been tested include polymerized oils, poly*iso*butylene (P.I.B.), arochlor, and silicone putty. In the case of P.I.B., viscosities were checked by the falling-ball method over a range of temperatures, and the results so obtained agreed within *ca* 5%.

In discussing the origin of shear elasticity in liquids, it is suggested that the low-shearing modulus obtained with P.I.B. is connected with a combination rotation and translation which occur with different activation energies. H. C. E.

1208. The Cragoe L Function for the Viscosity of Oils under Pressure at Certain Temperatures. R. B. Dow. *J. Coll. Sci.*, 1948, **3**, 99–109.—The viscosity η of an oil can be written as $\log \eta = \log A + B/L$, where A and B are constants and L is the Cragoe viscosity function. The temperature and pressure coefficients of L are given by

$$\alpha = (L_t - L_{t_0})/(L_{t_0}(t - t_0)) \quad \text{and} \quad \beta = (L_1 - L_p)/L_p(p - 1)$$

respectively, where L_t, L_{t_0}, L_p, L_1 are the values of L at t and t_0 °F and pressures p and 1 kg/cm² respectively. The values of L_1, α, and β have been computed for twelve representative petroleum oils over a pressure range of 28,000 p.s.i. and temperatures from 100° to 210° F.

It was found that: (1) a plot of $\log \eta$ against $1/L$ did not give a straight line; (2) β is a function of pressure, and its magnitude and variation depend on the type of oil; (3) for paraffinic oils, α passes through a minimum with increase in pressure; for naphthenic and aromatic oils, α slowly increases with increase of pressure. In discussing these results the logarithmic equation for L has been interpreted in terms of current reaction-rate theory. Volume effects alone are not adequate to account for the changes in β, and it is suggested that orientation effects during viscous flow are probably responsible for the discrepancies between theory and experiment.

H. C. E.

Analysis and Testing.

1209. Chemistry–Physics Laboratory opened by Socony Vacuum Oil Co. at Paulsboro', N.J. Anon. *Oil Gas J.*, 10.6.48, **47** (6), 87.—The new research plant at Paulsboro', N.J., occupies 49,000 sq. ft, employs 120 chemists, and forty-five physicists.

Facilities include two 300-ton refrigeration units, two cold rooms, a glass-blowing department and rooms fitted with explosion-proof equipment, and a large machine shop. An X-ray camera, and an electron microscope capable of 100,000 diameters magnification is among other apparatus provided.

Development work on jet fuels is going forward. G. A. C.

1210. Indiana Standard's New Research Lab. Houses Highly Organized Activity. R. B. Tuttle. *Oil Gas J.*, 20.5.48, **47** (3), 196.—The new Whiting, Indiana, research laboratories of the Standard Oil Co. are described. They occupy 7 acres of floor space and employ approximately 1200 workers.

A catalyst development laboratory is among other features of the equipment, which also includes a general process laboratory. G. A. C.

1211. Interfacial Tension Test and Its Significance in Appraising Performance of an Insulating Oil. G. W. Gerell. *A.S.T.M. Bull.*, May 1947, **146**, 92–95.—The conditions leading up to the formulation of the interfacial tension test as a means of assessing the degree of sludging in transformer oils are outlined, and correlations of interfacial tension with power factor, saponification, and neutralization numbers are discussed. In the case of power factor it is suggested that adequate correlation is dependent upon tests being taken on anhydrous samples. The results of a series of tests of 3½ years followed by the internal inspection of transformers indicated that sludging was usually present with an interfacial tension number of 15 or less, while all oils with an interfacial tension number of 21 or more were free from sludge. J. G. H.

1212. Application of the Interfacial Tension Test in Grading Oil in Transformers Relative to Serviceability. E. F. Walsh. *A.S.T.M. Bull.*, May 1947, **146**, 95–98.—The application of power factor and interfacial-tension tests to the serviceability of transformer oil is described, and a new concept, that of "quality factor," is derived, having a range of from 0 to 100, zero being oil no longer serviceable and 100 being oil in excellent condition. The relation of the quality factor to neutralization number and power factor is discussed, and the effect of moisture content of the oil considered. From the resultant data an experimental control graph is constructed which enables the quality factor to be registered when the interfacial tension and power factor are known. J. G. H.

1213. Infra-Red Spectroscopy in the Aero and Motor Fuel Industry. L. W. Marrison. *Industr. Chem.*, 1948, **24**, 441–447.—A general indication is given of the application of infra-red spectroscopy to the detection and estimation of hydrocarbons present in narrow-boiling fractions, and to gas analysis. The Grubb-Parsons infra-red gas analyser is described; it is suitable for routine analyses of samples containing few constituents. E. B.

1214. Determining Consistency on Small Samples of Lubricating Grease. R. F. McKibben. *A.S.T.M. Bull.*, May 1947, **146**, 74–77.—The Disk viscometer developed as an alternative to existing equipment can be used in the determination of apparent viscosity of lubricating greases on samples as small as 4 mg and has a viscosity range of from 200 to 500,000 S.S.U. Constructional details and methods of operation are described and reproducibility of results is discussed. J. G. H.

1215. Machine for Testing Gear Materials and Lubricants. Anon. *Machinery*, 13.5.48, **72**, 593.—The article describes a machine developed by Messrs. David Brown & Sons (Huddersfield) Ltd. for the testing of gear materials and lubricants, and is designated The Self-Aligning Disc Machine. The machine, the principal of which was used in the Amsler machine in 1922, is based on an earlier David Brown machine and was developed with the object of assessing the performance of contacting surfaces and of lubricants in connexion with development work concerned with gear materials and

lubricants. In the apparatus two discs of the material under investigation rotating with either equal or different circumferential speeds are pressed into contact with each other under a predetermined load. The coefficient of friction between the discs under any operating conditions may be determined. The machine may be used with a standard lubricant to determine the characteristics of any particular combination of materials or with the standard material combination to test a lubricant. Constructional details of the machine and its application to study particular problems, such as worm or helical bevel gears, are described. C. D. B.

1216. Method for Evaluating the Physico-Chemical Properties of a Liquid, Particularly its Combustibility. G. N. Khudyakov. *Bull. Acad. Sci. U.S.S.R. Div. Tech. Sci.*, 1948, 579–584.—A method and apparatus have been developed for measuring the rate of evaporation of a liquid from a free surface, due to heat radiated from a source, maintained at a constant temperature above the liquid; heat transfer by conduction and convection being absent in such circumstances. The rate of volatilization of an inflammable liquid, in these conditions, is a measure of its combustibility. Graphite and oxidized aluminium were used as heat radiators, being maintained at 400° C and 209° C respectively. The quantity of heat absorbed by a liquid, under standard conditions, is a characteristic of the liquid and for volatile mixtures the temperature of the evaporating layer is constant for a given composition. Curves are given relating thickness of evaporated layer to time for benzene, *iso*butyl alcohol, water, carbon disulphide, and carbon disulphide–benzene mixture. V. B.

1217. New Hot-wire Vacuum Gauge. H. von Ubisch. *Nature*, 1948, **161**, 927.—The range of the conventional hot-wire vacuum gauge can be extended to 10 mm Hg pressure by increasing the current supplied to the wire as the pressure is increased. A circuit for applying this increase automatically is described, and calibration curves for several common gases are given. H. C. E.

1218. Penetroviscometer for Very Viscous Liquids. J. J. Bikerman. *J. Coll. Sci.*, 1948, **3**, 75–85.—The instrument consists essentially of a glass tube containing the test material, through which a weighted brass plunger is allowed to fall. The descent of the plunger is observed by means of a low-power microscope. The theory of the instrument is worked out, and expressions for the viscosity of the test material are deduced in terms of the rate of fall of the plunger, the dimensions of the tube, and the load on the plunger. The penetroviscometer was tested with liquids of different viscosities and with varying loads on the plunger, and it is concluded that viscosities ranging from 10^3 to 10^4 poises can be measured with an accuracy of $\pm 2\%$. H. C. E.

1219. Effect the Consistency Curve Has Had on Development of Modern Viscometers. H. Green. *J. Coll. Sci.*, 1948, **3**, 129–133.—Methods of viscosity measurement by capillary viscometers from stress *vs* rate of shear diagrams depended upon: (1) the upper portion of the diagram being linear, and (2) the non-linear part being due either to slippage or seepage flow. It was subsequently shown that the consistency curve is a hyperbola (containing four variables), and that the curvature at the lower end is due to a gradual change from plug to laminar flow. Hence for all except Newtonian liquids one should use a rotational viscometer, which gives a linear consistency curve when laminar flow sets in. The rotational viscometer can also be used in measurements of thixotropic systems. H. C. E.

1220. Pilot Pipeline Unit for Determining Viscosity–Temperature Relationships. R. B. Beckmann, H. G. Corneil, and R. J. Micheal. *Trans. Amer. Inst. Chem. Engrs*, 1946, **42**, 947–958.—A pilot pipeline unit used for determining the apparent viscosities of high vapour-pressure, waxy crude-oil samples at various temperatures consists of 60 ft of 0·314-in seamless tubing comprising two straight 30-ft sections connected with a U bend, the whole being enclosed in a liquid-propane constant-temperature bath. An oil charge of 20 gal is required for operation, and is supplied from a blend tank of 30 gal capacity. The technique used and typical data obtained are presented. Comparison of results obtained with those from trunk pipelines revealed a very close agreement. J. G. H.

Engine Fuels.

1221. New Fuel Systems Needed to Allow Greater Butane Use, Refiners Told. A. L. Foster. *Oil Gas J.*, 20.5.48, **47** (3), 122.—Shortages of fuels could be relieved if designers of automotive engines would increase the tolerance of their fuel systems for more highly volatile fuels. More butane and light products should be used.

An increase in summer vapour-pressure tolerance from 8 to 12 lb would increase total U.S. gasoline production by about 10%, thus more than offsetting volume loss sustained when improving octane number by 10 points. G. A. C.

1222. Correlation of A.S.T.M. True Boiling Point and Flash Vaporization Curves. W. L. Nelson and R. J. Harvey. *Oil Gas J.*, 17.6.48, **47** (7), 71.—Forty-five true-boiling-point and 28 A.S.T.M. distillation curves were correlated with their flash-vaporization curves.

The straight-line slope of the distillation curve was related to that of the flash-vaporization curve in the same manner as used by Nelson and by Packie.

It is concluded that the relationship of distillation-curve slope to flash-curve slope is not a function of the boiling range of the material.

The empirical relationships developed should not be applied to stocks where distillation curve is not substantially linear. G. A. C.

Gas Oil and Fuel Oil.

1223. Heating Installation of Victoria Hotel, Sidmouth. Anon. *Heating Ventilating Engr*, June 1948, **21**, 535.—The designers were asked to provide a first-class installation giving maximum efficiency and reliability coupled with cleanliness and a minimum of labour for operation. For these reasons a steam installation with two automatic oil-fired " Oilex " boilers was chosen. 250 sec viscosity heavy fuel oil was selected as the fuel and a pre-heater was fitted in the supply line. Storage for 5000 gal of oil was supplied. The installation is absolutely silent in operation. D. W. J.

1224. Gas Oil and Fuel Oil. Anon. *Heating Ventilating Engr*, Mar. 1948, **21**, 378.—An investigation is being carried out at the research laboratory of the Institution of Heating and Ventilating Engineers, in co-operation with the Oil-Heating Institute of America, to develop a means of differentiating between the burning characteristics of fuel oils resulting from straight-run distillate processes and those containing, or consisting entirely of, products from catalytic-cracking plants. These studies will have an important bearing on the future of oil-fired heating equipment. D. W. J.

Lubricants.

1225. Molecular Adsorption and Surface States in Lubrication. J. J. Trillat. *Bull. Assoc. franç. Tech. Pétrol.*, 1948 (69), 17–44.—The first part of this lecture deals with the influence of the molecular structure of the oil on adsorption. The measurement of the interfacial tension between oil and water (which can indicate the concentration of polar additives in the oil) is described. If steel balls are placed in contact with a non-polar oil containing a known concentration of oleic acid, adsorption of the latter on the metal surface causes a decrease in its concentration in the oil, and hence the thickness of the adsorbed layer (10–20 mols) can be determined. Curves are given showing the relation of interfacial tension, between mineral oil containing stearic or oleic acid and water, with time and temperature; a rise in the latter causes a decrease in the significance of adsorption phenomena. Results obtained with stearic and oleic acids indicate that a double bond favours adsorption. Surface activity increases with lengthening C chain, reaching a steady value at about C_{14}. In the case of oleic acid there is a transition point at 44° C between two states of the adsorbed film. In the second part of the paper the influence of the surface structure of the metal is discussed. For a reduction in the coefficient of friction to occur, the presence of moisture is essential. A metal surface freshly prepared under vacuum exhibits highly accentuated adsorption properties. Brief mention is made of the use of radio-active tracers in the study of adsorbed oil films. V. B.

1226. Heavy Duty Lubricants. E. Tyrrell. *Oil Engine*, Mid-May 1948, **16**, 8.—The article is a review of a paper recently published in the *Journal of Naval Engineering* and is reproduced by courtesy of the Admiralty. The history of the introduction into Great Britain of heavy-duty oils is traced, and reasons for the lag in their development in Great Britain and for the poor reception they received from the British Army when first tried out are given. The introduction of heavy-duty oils into the Navy led to a reduction in the quantity of spares used, increased service between overhauls, and the adoption of new highly rated engines. Tests carried out by the Institute of Petroleum, at the request of the Royal Navy, with a large transport company, also demonstrated the advantages of the use of heavy-duty oils. Service instructions for the change-over from straight mineral to heavy-duty oils are detailed. C. D. B.

1227. Preparation of Lubricating Oils from Hydrocarbon-Synthesis Products (2). G. H. Dazeley and C. C. Hall. *Petroleum*, Feb. 1948, **11**, 41.—This is the second paper dealing with the preparation of lubricating oil from the products of thermal cracking of synthesis products.

Material of b.p. $<170°$ C, having a Bromine No. of 148, was polymerized at various reaction temperatures and the 170–200° C fraction (Bromine No. 45) at 80° C. Properties and yields of the lubricating oils produced are given. The results showed that an increase in reaction temperature gave an oil of lower viscosity from a given fraction of spirit, while not affecting the V.I. Higher-boiling fractions gave oils of lower viscosity and higher V.I. than those from the lower fractions.

Oils from the spirit b.p. $<170°$ C showed a low stability to air blowing at 200° C; oil from the 170–200° C fraction was much more stable.

This increased oxidation stability of the oils from the higher-boiling fractions is in strong contrast to the behaviour of oils from various fractions of the product of synthesis from water gas. These oils showed about the same relative increase in viscosity on air blowing.

This difference is of importance, since untreated lubricating oils of the olefin-polymer type have persistently failed the D.T.D. 109 specification only in their low resistance to oxidation.

Variation in cracking temperature and throughput had no great effect on the yield or V.I. of the oils. Recycling of the higher-boiling cracked material yielded products possessing nearly the same good viscosity–temperature properties as those from the initial cracking, but the oxidation number deteriorated.

Experiments on the polymerization of fractions of the cracked product showed that the higher fractions (200–240° C) gave oils of high V.I. and better oxidation stability meeting the D.T.D. 109 specification for summer oil. F. W. H. M.

1228. Penetration of Block Greases. L. C. Brunstrum and A. W. Weitkamp. *A.S.T.M. Bull.*, Dec. 1947, **149**, 48–50.—A study of A.S.T.M. penetration values obtained on hard greases revealed the cross-sectional area of the cone tip at the surface of the grease cake as the critical factor, the depth of penetration being a convenient measure of the cross-section. Reproducibility of results is conditioned by closer dimensional tolerances in the manufacture of cone tips. J. G. H.

1229. Barium Lubricating Grease. C. J. Boner and G. W. Miller. *Institute Spokesman*, June 1948, **12** (3), 20.—The respective fields of application of oils and greases as lubricating media are enumerated and the characteristics of individual metallic-base greases are discussed. Barium grease, by reason of its high melting point, high water resistance, cohesive and adhesive qualities, has a wide application. Specific uses over a wide range of industries are described. J. G. H.

1230. Thixotropic Characteristics of Lubricating Oil Greases. L. W. McLennan and G. H. Smith. *A.S.T.M. Bull.*, May 1948, **152**, 71–75.—The desirability of a clear understanding of the basic principles governing the thixotropy of greases as a means of establishing methods of measuring, predicting, and controlling the behaviour of greases, is emphasized. The relative advantages of penetration, power requirements, and capillaries as methods of investigation are discussed together with the healing and breakdown processes and the degree of reversibility. Finally, the practical applications of thixotropic characteristics are indicated. J. G. H.

1231. Use of Inhibitors in Corrosion Control. N. Hackerman. *Corrosion*, Feb. 1948, **4**, 45–60.—The employment of materials as inhibitors is described from the standpoint of effect on corrosive media, effect on metal-inorganic chemicals and effect on metal-organic substances. The effectiveness of inhibitors under special conditions as opposed to indiscriminate application is emphasized, governing conditions considered including type of corrosion, nature of corrosive products, and effect of temperature. Theories of inhibitors are discussed with particular reference to the relation of adsorption.

J. G. H.

1232. Inhibitor Action in Crankcase Lubricants. A. F. Prutton. *Oil Gas J.*, 10.6.48, **47** (6), 70.—The general factors concerned in the corrosion of copper–lead bearings are discussed, and the functions of a crankcase lubricant broadly considered. Corrosion problems may be divided into those involving ferrous metals and those concerned with non-ferrous metals. Modern trends in fuel composition may require extremely high concentration of corrective additives in the lubricant.

The corrosion of pure lead and of copper–lead bearing metal by hydrocarbon solutions has been studied, and among conclusions reached are that corrosion of lead requires presence of both an organic acid and an oxidizing agent; and at high concentrations of oxidizing agent the rate of corrosion rapidly increases.

Corrosion inhibitors may act by chemical or catalytic reduction of oxidizing agent, or by forming an inhibiting film on the bearing surface, or by modification of the oxidation of the lubricant.

Five different types of commercially used crankcase corrosion inhibitors were studied, and the results tabulated. Both laboratory and engine tests were carried out, and results in the latter tests were tabulated under loss of additive, corrosion inhibition, oil deterioration, and engine cleanliness. Four tables and six figures illustrate the article.

G. A. C.

1233. Evaluation of Inhibited Turbine Oils Versus Uninhibited Turbine Oils for Turbine Lubrication. M. D. Baker. *A.S.T.M. Bull.*, May 1948, **152**, 59–61.—The advantages of oxidation-inhibited turbine oils as a contributory factor in power-plant operation are enumerated from the standpoints of life of the oil, cleanliness of the oil system and corrosion. The action of chemical cleaning of oil coolers and the addition of 10% of old oil as a corrosion inhibitor are discussed, together with bearing failures due to faulty design and frequently attributed to the use of oxidation-inhibited oils.

J. G. H.

1234. Service Experience with Turbine Oils. C. L. Pope and O. V. Sprague. *A.S.T.M. Bull.*, May 1948, **152**, 62–64.—Operating experience on lubricating systems of steam-turbine generating plant over a period of 18 years with three types of oil, a non-solvent-refined non-additive type, a solvent-refined non-additive type and a solvent-refined oxidation-inhibited oil is described. Variations in interfacial tension, rusting of oil-drain lines, and film strength in gear-lubrication problems are discussed.

J. G. H.

1235. Care of the Lubricant and Maintenance of the Lubricating System for Central Station Turbine Equipment. E. F. Walsh. *A.S.T.M. Bull.*, May 1948, **152**, 64–66.—Preliminary treatment of turbine equipment in order to avoid acceleration of deterioration of lubricating oil by direct contact with metallic surfaces is described, and procedure prior to the substitution of inhibited for non-inhibited oils is outlined. Performance records with inhibited oils over a period of seven years are presented.

J. G. H.

1236. Steam Turbines and their Lubrication. C. D. Wilson. *A.S.T.M. Bull.*, May 1948, **152**, 66–70.—The special conditions obtaining in steam-turbine installations are outlined, recommended oil viscosities for direct-connected, geared generators and turbines for marine propulsion are tabulated, and a typical lubrication system for a steam-turbine generator unit is described. Data on present-day practice for system capacity and rate of circulation for generator units from 500 to 165,000 kW are presented and the requirements for a theoretically ideal turbine oil are reviewed.

J. G. H.

1237. Steam Turbine Lubrication Problems and Their Solutions. 5. "Secondary" or "Acid Condensate Corrosion" Rusting (1). A. Wolf. *Petroleum*, Apr. 1948, **11**, 86.—This paper describes "secondary" rusting which occurs more particularly above the normal oil level in the reservoir. Its mechanism and prevention and the behaviour of variously refined oils on oxidation are discussed.

"Secondary" rusting is a condensation phenomenon occurring only when the oil has developed strong organic acidity which is rapidly increasing. In severe cases rust stalactites are built up, forming hollow growths consisting of hydrated ferric oxide and magnetic oxide full of a dilute aqueous solution of lower organic acids and their iron salts.

Appreciable amounts of low mol. wt. organic acids, including acetic acid, may be formed on oxidation of the oil, which, with the moisture invariably present, cause the "secondary" rusting. Iron salts formed by the action of the lower acids on the unprotected reservoir ceiling fall back into the oil and by reaction with the higher acids in the oil form powerful oxidation catalysts.

Dangerously obstructive deposits may easily arise as the oil becomes saturated with the iron soaps and they are thrown out of solution with other insoluble oil-deterioration products.

The obvious measure to prevent secondary rusting is therefore to prevent or inhibit oxidation.

A characteristic of solvent-refined oils, particularly those from asphalt-base and mixed-base crudes, is that both in *long-time* oxidation tests and under severe service conditions they develop high acidity prior to the formation of asphaltic sludge or matter insoluble in aromatic-free naphtha. In this connexion the value of the acidity test is stressed.

With "conventionally" refined oils, sludge and acid formation run roughly parallel and in a long-time oxidation test the non-solvent-refined oils show less deterioration than the solvent-refined oils.

The standard short-time oxidation tests are therefore considered of limited value and may be misleading if incorrectly interpreted. F. W. H. M.

1238. Steam Turbine Lubrication Problems and Their Solutions. 5. "Secondary" or "Acid Condensate Corrosion" Rusting (2). A. Wolf. *Petroleum*, May 1948, **11**, 113.—Consideration is given to the reduction in oil stability by "over-refining" as exemplified in the development of high acidity when highly refined oils are subjected to an oxidation test, *e.g.*, Michie Sludge Test, for say, 200 hr even at lower temperatures.

The explanation that this is due to removal by refining of "natural inhibitors" is confirmed by the effects of adding synthetic inhibitors.

The advantages of using such inhibitors are discussed.

Since all the main functional surfaces of a turbine operate under "full-film" lubrication conditions, a high degree of "oiliness" is not called for.

Whereas intensive refining to a very pale colour removes the more "polar" compounds and "natural inhibitors," the response to the addition of oxidation inhibitors is thereby greatly improved. The explanation for this is so far not clear, since the "artificial" oxidation inhibitors appear to function efficiently only in oils which are as "inert" as possible. F. W. H. M.

Bitumen, Asphalt, and Tar.

1239. Electrical Stabilization of Soil. E. S. Barber. *Roads & Streets*, June 1948, **91** (6), 64.—The possible methods of using electricity in stabilizing soil and theory involved are discussed.

Practical applications have been limited to special projects where the need for solution of problem was more important than cost, which was often high.

Two figures illustrate the article. G. A. C.

1240. Rheological Investigations of Asphaltic Bitumen with its Technical Applications. R. N. J. Saal. *J. Inst. Petrol.*, 1948, **34**, 69.—At ordinary temperatures bitumens show a rheological behaviour according to one of the following three types: (1) a viscosity practically independent of shearing stress; (2) a viscosity substantially independent of stress after a certain deformation, but accompanied by a distinct

elastic fore- and after-effect; (3) a retarded elastic deformability with appreciable permanent deformations of a thixotropic character only at high shearing stresses or long deformation times. The factors governing these differences are discussed. The rheological properties of bitumen–filler mixtures obey the Einstein law for low concentrations of filler, but knowledge of the behaviour of these mixtures is incomplete. For mixtures with coarse aggregates theories explaining the plastic properties are put forward on the evidence of static tests. The connexion between the mechanical condition of a bituminous mixture and the corresponding condition of the bituminous component is discussed, and it is concluded that no direct connexion is obvious from the experimental facts. A. R. W. B.

Special Hydrocarbon Products.

1241. Toxicity of D.D.T. Residues. R. W. Fay, E. L. Cole, and S. W. Simmons. *Soap & Sanitary Chemicals*, June 1948, **24** (6), 130.—By means of laboratory tests with adult female *A. quadrimaculatus* mosquitoes, certain relationships between the residual toxicity of various D.D.T. spray applications and different types of surfaces and surface treatments were ascertained. D.D.T. deposits from D.D.T.–xylene emulsion, D.D.T. kerosine solution, and water wettable D.D.T. suspensions were investigated, and effects of household cleaning and maintenance operations studied. G. A. C.

1242. Economic Outlook for Synthetic Detergents. M. Sittenfield. *Chem. Ind.*, Apr. 1948, **62** (4), 584.—In assessing the relative positions of fatty acid soap and synthetic detergents in America it is realized that competition between these two products will increase considerably during the next few years. The most likely rival for soap will probably be synthetics based on glycerine from the petroleum chemical industry. Alkyl aryl sulphonates, particularly due to their low cost, will not fall far behind, but will be more important in fields where fatty acid soap is not normally applied. O. M.

1243. Synthetic Detergents with Special Reference to Those Derived from Petroleum Products. P. R. Stedehouder, P. W. O. Wijga, and H. F. Dammers. *I.P. Review*, May 1948, **2** (17), 149.—Defects in fatty acid soaps such as hard water instability, and the war-produced shortage of fatty acids, have led to the present very large production of anionic, cationic and non-ionic synthetic detergents which has replaced fatty acid soap in many applications. A relatively high proportion of this synthetic production is based on petroleum products as raw materials. The most important of these are secondary alkyl sulphates and alkyl aryl sulphonates in the production of both of which olefins obtained by the cracking of petroleum hydrocarbons are utilized. A further interesting development is the catalytic oxidation of paraffin wax to yield products similar to fatty acids which can be used either in the manufacture of soap or of edible oils.

In this article is given a short description of the theory of detergency, wetting, and emulsification, and the appendix contains a list of various synthetic detergents and their structures. O. M.

1244. Oxidation Inhibitors in Electrical Insulating Oils. L. J. Berberich. *A.S.T.M. Bull.*, Dec. 1947, **149**, 65—74.—The complex composition of transformer oil and the influence of refining on relevant properties are discussed. The oxidation mechanism and the mechanism of oxidation inhibition are explained; laboratory tests on inhibited transformer oils are tabulated, and the correlation of degree of refining with effective amount of inhibitor is discussed. The evaluation of inhibited oils in terms of service life, the behaviour of oil mixtures, and other methods of improving oil performance are considered. J. G. H.

1245. Power Factor of Insulating Oils, Its Significance and Methods of Testing Stability. J. C. Balsbaugh. *A.S.T.M. Bull.*, Dec. 1947, **149**, 75–83.—The significance of the power factor of an insulating oil is discussed and the effect of oxidation and ionic and dipole losses on power-factor stability are considered. Analysis of the power factor of oil-paper as influenced by oxidation conditions, and of the dissipation factor of

oil-paper in terms of dissipation factors of the components are followed by a consideration of the effect of corona discharge on power factor. Test results are given on experimental samples illustrative of the characteristics described. J. G. H.

1246. Emulsion Polishes. E. J. Schnieders, W. F. Gross, and C. M. Blair. *Soap & Sanitary Chemicals*, June 1948, **24** (6), 145.—The application of certain microcrystalline waxes and their formulation in combination with resins, natural waxes, and various emulsifiers is dealt with. Of the two tables given, one deals with the compatibility of specially refined microcrystalline waxes with various vegetable waxes and synthetic resins. G. A. C.

1247. Advantages of an Inhibited Transformer Oil. T. E. Reamer and R. C. Larsen. *A.S.T.M. Bull.*, Dec. 1947, **149**, 58–65.—Factors leading to the deterioration of transformer oils in service are discussed. The function of inhibitors in increasing the effective life of the oil is described, and present methods for the accelerated testing of oils are reviewed, their shortcomings being enumerated. The new Shell Development Accelerated Transformer Oil Test, which measures the oxidation rate and is terminated at a fixed degree of deterioration, is described in detail. Results of tests on inhibited and conventional oils using the method are tabulated. The effects of blending oils from various sources are described, and the value of stability tests in full-size transformers as a check on new methods is emphasized. J. G. H.

1248. Serviceability Tests on Transformer Oil from the Viewpoint of the Maintenance Engineer. F. J. Pohnan. *A.S.T.M. Bull.*, Dec. 1947, **149**, 84–89.—The importance to the maintenance engineer of reliable information as to how much the transformer oil has changed, how far it has deteriorated, and how much risk is involved in further operation is emphasized. The mechanism of oil oxidation and the resulting changes are described. The effect of service on oil and insulation are considered, together with the causes of oil deterioration, the determination of condition, and serviceability of the oil. It is suggested that there is an urgent need for the establishing of limiting oxidation values and for standardized interpretation of test results. J. G. H.

1249. Steam-Emulsion Number as an Index of Transformer Oil Serviceability. M. D. Baker. *A.S.T.M. Bull.*, May 1947, **146**, 90–92.—The application of the steam-emulsion test, originally intended for lubricating oils, to insulating oils is discussed, and conditions leading to confusion in interpretation are outlined. Bushing troubles and the effects of bushing compounds on steam-emulsion numbers are considered, and the advantages of careful observation during the running of the tests, in addition to merely obtaining a number for oil analysis, are emphasized. J. G. H.

1250. High-Molecular Waxes from Crude Oil. E. Stossel. *World Petrol.*, June 1948, **19** (6), 52–53.—Methods are described for the production of high mol. wt. waxes from residues, by-products of lubricating oil dewaxing, and emulsions formed in crude tank bottoms. Most of the waxes are produced by solvent-extraction processes using polar solvents to separate heavy oils. A recent development is the separation of oil-free waxes directly from crude oil which is first thermally treated at a temperature above that required to dissolve the wax. Oil-soluble asphaltic matter interacts with resins and micro-crystalline waxes which become colloidally dispersed. Pour point and viscosity are reduced, and hysteresis occurs. Slow coagulation takes place with deposition of a filterable precipitate almost exclusively waxes, asphalts, and resins, whilst the heavy oils remain in solution. The crude waxes compare favourably with petroleum asphalts in several respects, *e.g.*, sharp m.p., low viscosity when melted and low water-absorption properties. " Blowing " of asphalt-waxes results in polymerization of the asphaltenes with increase of viscosity; the waxes remain unchanged. Acid treatment and percolation of the crude waxes give refined high m.p. waxes. E. B.

1251. Ester Waxes from British Peat. C. M. Cawley, J. H. G. Carlile, and C. C. Noaks. *Petroleum*, Apr. 1948, **11**, 77.—There are numerous deposits of peat in Great Britain. The amount of ester wax extractable by benzene varies from 3 to 17%, and is about 5–8% for more than half the peats.

There should be no difficulty in choosing a deposit conveniently situated for develop-

ment, which would provide a sufficient source of peat yielding about 10% wax. The establishment of a peat industry might have a significant effect on the larger project for the winning of peat for fuel purposes.

Peat wax is in many ways similar to Montan wax; it differs, however, in several important respects and cannot, therefore, be used as a direct substitute. Peat wax in general contains more resinous and asphaltic matter, is not completely miscible with paraffin wax and has a lower melting point (by about 10–15° C). The crude wax can be refined by solvent extraction to render it miscible with paraffin wax or "bleached" by oxidation to yield a pale yellow wax.

Further studies of peat wax, and of methods of treatment to render it more acceptable to the user are necessary. F. W. H. M.

1252. Production of Waxes from California Crudes. R. A. David and P. M. Huemmer. *Chem. Eng. Prog.*, Apr. 1947, **43** (4), 174–176.—The production of premium-grade lubricating oils from waxy Californian crudes has resulted in the accumulation of crude wax which calls for special processing for profitable disposal. The refining of crude wax is carried out using methylethyl ketone as solvent; distillation, de-oiling of distillates, and decolorizing of de-oiled wax fractions are described with the aid of a flowsheet. J. G. H.

Derived Chemical Products.

1253. Non-Ionic Detergents. G. E. Barker. *Soap & Sanitary Chemicals*, June 1948, **24** (6), 46.—A review of the required properties of effective detergents, effect of non-ionic detergents on the detergency of anionic types, and application of non-ionic products is given.

Non-ionic detergents are compatible with a wide range of materials, do not irritate the human skin nor de-fat it to as great an extent as do other types, and they enhance the detergency of many anionic products. G. A. C.

1254. Production of Ethylene from Ethane, Propane. H. C. Schutt. *Chem. Eng. Prog.*, 1947, **43** (3), 103–116.—The production of ethylene from light saturated hydrocarbons comprises two operations, the conversion of the charge by pyrolysis and the separation of the conversion products. General considerations in the design of commercial pyrolysis coils are discussed, together with performance characteristics and the pyrolysis of complex mixtures. Available data amplified by experimental results indicate that an elevated pressure of 30–40 p.s.i. and a reaction time of 0·7–1·3 sec will be necessary in commercial pyrolysis coils. Product distribution is established for the pyrolysis of ethane, propane, propylene, and butylene components of the reaction-coil charge on the production of ethylene from an ethane–propane mixture on recycling. A general procedure for establishing the recycle, pyrolysis-coil charge, and reaction products is described, together with the method used in the stepwise analysis of the reactant flow through the cracking coil. J. G. H.

1255. Physical Factors Affecting the Toxicity of Sprays to Stored Product Insects. 1. The Quantity of Carrier in Which a Given Amount of Active Ingredient is Applied. P. S. Hewlett. *Annals Appl. Biology*, Mar. 1948, **35**, 84–93.—A discussion of results from many tests, using D.D.T., Pyrethrins, and Gammexane as the toxic ingredients, and kerosine, odourless distillate, and Shell Oils 24210 and P. 31 as carriers. The test insects were house flies, mosquitoes, ticks, and flour beetles, and methods of application included mists, sprays, and films on plaster and filter paper. Data are presented in tabular form.

In general, an increase in the concentration of active ingredient for a given amount of insecticide used will cause an increase in mortality, but it appears that the concentration at which an active ingredient is best applied can depend upon the nature and quantity of the active ingredient and the method of application of the spray. There may be other factors.

Apart from results of tests the problem is approached theoretically, and the following equation is presented and discussed:—

$$\frac{dy}{dx_1} = -\frac{dy}{dx_2} = \frac{\partial y}{\partial x_1} - \frac{\partial y}{\partial x_2}$$

where y is % mortality and x_1 and x_2 are respectively log-concentration of active ingredient and log-volume (or deposit) of insecticide applied. Probit mortality, Y, can be substituted for y.

There are thirteen literature references. W. M. H.

1256. Space Spray Toxicity. W. A. Gersdorff and M. S. Schechter. *Soap & Sanitary Chemicals*, June 1948, **24** (6), 155.—The toxicity to house flies of space sprays (kerosine) containing certain diaryl ethers and pyrethrins extract is dealt with. Two tables give the results, one showing effect of kerosine sprays containing certain substituted diaryl ethers mixed with 0·5 mg/ml of pyrethrins. G. A. C.

1257. Residual Toxicity. J. H. Beacher and W. L. Parker. *Soap & Sanitary Chemicals*, June 1948, **24** (6), 139.—Various surfaces, including pebbled glass, unpainted wood, Celotex, water paint, and whitewash on which the toxicant was sprayed after drying, treated with comparable 10% water emulsions of Toxaphene, a chlorinated camphene, and D.D.T., were compared for residual effectiveness against the house fly over a period of 225 days.

D.D.T. proved superior to Toxaphene in speed of knock-down and in six-hour mortality for all surfaces tested. Other conclusions were that toxicants in freshly mixed paints were more effective than in aged paints with oleoresinous enamel, flat wall paint, and gloss water paint, but in aged paints were superior in washable flat wall paint.

Four tables illustrate the work. G. A. C.

Coal, Shale, and Peat.

1258. Production of Manufactured Gas Using Turbine Cycles. F. J. Jenny. *Chem. Eng.*, 1948, **55** (4), 108–111.—The incorporation of the gas turbine into a continuous process for the conversion of coal to gas is discussed. A variety of processes are outlined, using a mixture of solid and liquid fuels. The majority use oxygen rather than air for the gasification unit, and operate at 150 p.s.i.a. A quenching zone is introduced between the gasification unit and the turbine, which itself is followed by a waste-heat boiler and cooler.

If a sufficiently high compression ratio is used, it is possible that excess power, over and above that required for air and oxygen compression, will be made available.

The calorific value of the gas produced varies from 300 to 1000 B.Th.U/cu. ft, the higher value being achieved by conversion of hydrogen and carbon monoxide to methane and carbon dioxide, the latter being absorbed :—

$$2CO + 2H_2 = CH_4 + CO_2$$

Hence the power required for compression is small, there being one volume of gas per four volumes of preconverter gases. R. T. W. H.

Miscellaneous Products.

1259. Cutting Fluid Developments. J. M. Stewart. *Auto. Engr*, May 1948, **38**, 183.—Many interesting developments have taken place in the cutting-fluid field since the early days. One of the more recent of these is sulpho-chlorinated oils, where the most satisfactory products are those which contain sulphur and chlorine in the same molecule, allowing both these elements to be present at the surface of the oil film between work and tool. Thus very much increased E.P. properties are obtained. Such oils as this are usually blended with other oils of suitable viscosity. Two other advantages over normal cutting oils connected with these sulpho-chlorinated oils are : (*a*) they show less tendency to cause skin infection, and (*b*) they can easily be reclaimed, since they do not contain any additives which would separate using normal reclamation processes. O. M.

1260. Evaluation of Cutting Fluids in Laboratory Equipment. L. H. Sudholz. *Lubrication Engng*, Feb. 1948, **4**, 18–24.—A review of the theory of metal cutting is presented, followed by a summary of the required characteristics and general composition of cutting fluids. Physical and chemical tests for non-soluble cutting oils are described,

together with the following tests for soluble cutting fluids; stability upon freezing; stability of emulsions in tap and hard water; pH of emulsions and corrosion tests. Limitations of physical and chemical tests in the prediction of metal-cutting performance have resulted in the evolution of mechanical-testing equipment. Almen and Falex testers are described, and comparative figures for typical fluids are given and discrepancies discussed. Comparative results on laboratory test lathes, threading and tapping machines are discussed in relation to chemical composition and tool life. Emphasis is laid on the desirability of evaluating cutting fluids in actual metal-cutting operations and on the importance of correct interpretation of data. J. G. H.

1261. Water-Mixed Cutting Fluids. W. H. Oldacre. *A.S.T.M. Bull.*, Mar. 1948, **151**, 45–46.—The historical development of water-mixed cutting fluids is described. The effect of contamination on cooling properties is discussed, and the necessity of a comprehensive survey of the theory of metal cutting as an essential preliminary to further investigation is stressed. J. G. H.

1262. Cutting Fluids. E. A. Reehl. *A.S.T.M. Bull.*, Mar. 1948, **151**, 47–48.—Non-water-soluble cutting fluids only are considered, these being classified as straight mineral oils, sulphurized mineral oils, sulphur-chlorinated mineral oils, sulphurized fatty or vegetable oils, and sulphur-chlorinated fatty or vegetable oils. Functions of the special components, applications, and limitations of each type are enumerated. J. G. H.

1263. Correlation of Laboratory Testing of Cutting Fluids with Field Tests. D. J. Wangelin. *A.S.T.M. Bull.*, Mar. 1948, **151**, 48–49.—Field testing in the present case is defined as closely controlled tests run in the cutting-fluid user's plant under actual production conditions as opposed to field testing on a given fluid over a relatively long period. The conditions and equipment necessary for field testing are set out, and the importance of duration tests is emphasized. Methods of laboratory testing are described, and the necessity of a fuller understanding of the mechanics of metal cutting as a means of obtaining better correlation between field and laboratory tests is stressed. J. G. H.

1264. Incendiary Fuels for Various Purposes. C. M. Cawley, J. H. G. Carlile, J. G. King, and F. E. T. Kingman. *J. Inst. Petrol.*, 1948, **34**, 90.—An account is given of some of the work carried out at the Fuel Research Station for the Mixtures Committee of the Petroleum Warfare Department. The incendiary fuels studied were distinguished from pyrotechnics in containing a petroleum oil as a major constituent and were devised as fillings for fougasses, mortar shells, incendiary shells, and air-dropped bombs, and for other purposes. A. R. W. B.

1265. Classification and Uses of Plastic Coatings. J. L. Robertson. *Oil Gas J.*, 6.5.48, **47** (1), 72.—Plastic, or "organic," coatings are classified here in families based on the parent material, which usually conveys definite hereditary characters to the finished coating. By this means coatings may be evaluated and selected for specific uses.

The families chosen as the basis of the classification are: alkyd; drying-oil type; cellulose; phenolic heat reactive; phenolic varnishes; asphalt and coal tar; vinyl. Properties considered for each family are: drying method; application; method of film formation; pigment or filler; sunlight resistance; water resistance; compounds to which coating is not resistant; solubility; temperature limit; hardness; elasticity; adhesion to steel; special advantages. Data are arranged in tabular form. W. M. H.

1266. Low Temperature Rubber. Anon. *Chem. Eng.*, 1948, **55** (3), 109.—New butadiene-styrene synthetic rubbers made by the Phillips Petroleum Co. at sub-atmospheric polymerization temperatures are described. The discovery, by the Phillips Co., of rapid catalyst systems, has enabled lower polymerization temperatures to be used—as low as 0° C.

The elastomer properties are described as being superior in tread wear, to GR-S and natural rubber. R. T. W. H.

1267. Los Angeles Styrene Plant. H. H. Smith. *Chem. Eng. Prog.*, Apr. 1947, **43** (4), 152–154.—Plant is described for the production of styrene for synthetic rubber from benzene and ethylene, both being locally available from petroleum-processing plants. Flow diagrams are presented for the production of ethylene, ethyl benzene, and styrene. J. G. H.

1268. Tricresyl Phosphate—A Hydraulic Fluid and Lubricating Oil Additive. Anon. *Petroleum*, Apr. 1948, **11**, 83.—Fire hazards can be eliminated by the use of tricresyl phosphate as a hydraulic fluid. Its physical and chemical properties are tabulated, and uses as a lubricating oil additive discussed. Particular reference is made to its extreme-pressure properties. F. W. H. M.

1269. Uranium in Petroleum, Asphalts and Shales. S. G. Lexow and E. P. Maneschi. *Publ. Univ. Nac. Cuyo* (*Argentine*), 1948, **1**, 5–11.—The presence of uranium in the ash of three asphalts, four shales, and one crude petroleum from various sources in the Argentine has been observed, using a fluoroscopic method of analysis capable of detecting 10^{-7} mg of uranium. In no case was the quantity sufficient to warrant commercial exploitation. A. C.

1270. Existence of Uranium in Petroleum. E. Longobardi. *Bol. del Inst. Sudamericano del Petroleo*, 1947, **2**, 608–609.—Marked radio-activity has been observed in the ash from El Sosneado petroleum (province of Mendoza, Argentine). A. C.

Engines and Automotive Equipment.

1271. Balliol. Anon. *Flight*, 1.7.48, **54**, 13.—The Balliol is the first airscrew power turbine trainer to fly, the airframe being built by Messrs. Boulton Paul and the power plant (Mamba) by Messrs. Armstrong-Siddeley. A cut-away drawing is given of the airframe and the power plant, together with a few details of performance. I. G. B.

1272. Injector Nozzles for Two-stroke Engines. Anon. *Gas Oil Pwr*, 1948, **43**, 187.—In certain two-stroke engines the injector is placed in the centre of the cylinder head between two exhaust valves. Here it is exposed to the hot exhaust gases, and despite thorough water cooling the temperature of the nozzle valve seat approaches 600° F. This temperature results in: (1) reduction of hardness of component parts, making them prone to distortion and wear; and (2) carbonization of the fuel in the sac of the nozzle, leading to sticking of the valve. To overcome these difficulties a new design of nozzle has the fuel sac and needle valve located some distance inside the body of the nozzle. Access to the cylinder is gained by means of a multi-hole nozzle tip which is a loose fit inside the body of the nozzle and can dissipate its heat readily to the main injector body without overheating the region of the valve seat. H. C. E.

1273. The Truth about Diesel Exhaust Haze. Anon. *Diesel Pwr. Diesel Transportation*, Feb. 1948, **26** (2), 37.—Under this general heading, and in order to correct popular misconceptions concerning the characteristics of diesel engines, abstracts are given of the following four papers presented at a recent S.A.E. meeting, each dealing with a particular aspect of diesel exhaust smoke.

"*Smoke in High Speed Diesel Engines*," by J. J. Broeze and C. Stillbroer, discusses the theory of combustion and the influence of fuel properties on the formation of smoke, dealt with under "hot smoke," "cold smoke," and "smoke at acceleration." The general conclusions are that the test described gives an insight into factors and mechanisms involved in the combustion process and that pre-combustion-type engines show characteristics different from those with direct injection brought about by differences in fuel distribution. The advantages of the pre-combustion chamber are reduction in the tendency to smoke, reduced sensitivity towards fuel properties, reduced maintenance of injection systems, reduced cylinder deposits, and quieter running.

"*Influence of Injection Characteristics on Exhaust Smoke*," by M. Berlyn, summarizes

the author's findings: fuel-injection characteristics can have a profound influence on diesel exhaust smoke and injection equipment, and characteristics must suit each individual engine type. Standardization in engine design would reduce to vanishing point efforts within the diesel industry to match up engine and injection-equipment characteristics.

"*Rating Diesel Engines on Smoke Curve Basis*," by K. J. Fleck, describes methods of rating an engine according to the density of its exhaust smoke and concludes that the smoke curve is one of the measures of engine performance and gives more information than exhaust temperature.

"*A Technique of Exhaust Smoke Measurement*," by J. P. Jung and F. L. Coers, describes an investigation to establish a method of taking a smoke sample which, when measured by the C.R.C. smoke meter, would give consistently a comparative indication of the density of the main stream of exhaust smoke. C. D. B.

1274. German Marine Diesel Engines. Anon. *Gas Oil Pwr*, 1948, **43**, 157.—Taken from BIOS Overall Report No 2 (Shipbuilding and Marine Engineering in Germany During the Period 1939–45), this article notes various types of M.A.N engines, developing up to 2800 h.p. Mention is also made of an eighteen-cylinder M.A.N. two-stroke double-acting engine developing 28,600 effective h.p. at 255 r.p.m. with two vertical banks of nine cylinders each of 25·6-in bore and 37·4-in stroke. Experimental piston materials are mentioned, and some novel scavenging systems are described. H. C. E.

1275. Combined Gas and Steam Turbine. Anon. *Motor Ship*, June 1948, **29**, 114.—A short description is given of the proposed de Laval system with a thermal efficiency of 33%. The set comprises boiler, steam turbine, condenser, two stages of centrifugal compressor, intercooler, high-pressure gas turbine, low-pressure gas turbine, and high- and low-pressure combustion chambers. The cycle is similar in principle to that proposed some time ago by Oerlikon in Switzerland, and the distinct advantages of this type of plant are illustrated by the high fuel economy claimed. I. G. B.

1276. Equilibrium Running of the Simple Jet-turbine Engine. A. E. W. Morley. *J.R. aero. Soc.*, 1948, **52**, 305.—The paper discusses the elementary use of non-dimensional parameters for analysing the performance of a simple jet engine. The components of the engine—intake, compressor, combustion chamber, turbine and final nozzle—are linked together by means of the component characteristics. The possible running points are such that the characteristics are satisfied simultaneously when the whole of the engine is in equilibrium. I. G. B.

1277. Aerodynamics of the Gas Turbine. A. R. Howell. *J.R. aero. Soc.*, 1948, **52**, 329.—The efficiency and bulk of the compressor and turbine components in gas turbines are largely an aerodynamic matter, and details are given of the effect on design of lift and drag coefficients, Mach No., etc. I. G. B.

1278. Process for the Circumferential Photography of Engine Pistons and Bearings. M. Groff. *Rev. Inst. Franç. Pétrole*, 1948, **3**, 50–52.—An apparatus is described (with illustrations) whereby photographs can be taken of the entire circumference of pistons and bearings, which are rotated in front of the camera by a suitable mechanism. Specimen photographs taken by this method are reproduced. V. B.

MISCELLANEOUS.

1279. Petroleum—Today and Tomorrow. K. F. Mather. *Min. & Metall.*, June 1948, **29**, 318.—See Abstract No. 832 [1948].

1280. Petroleum Industry in December 1947 [Polish]. Anon. *Nafta*, Jan. 1948, **4**, 37 (Report Sect.).—Figures are given for production, natural gas, gasolines and other products, and imports.

A summary for 1947 includes details of drilling (depth), and of refining products. M. S.

1281. Report on the Activities of the (Polish) Petroleum Institute in 1947. H. Górka. *Nafta*, Jan. 1948, **4**, 35–37 (*Report Sect.*), Feb. 1948, **4**, 74–77 (*Report Sect.*), Mar. 1948, **4**, 114–116 (*Report Sect.*).—Details are given of the activities of the Petroleum Institute of Poland during the year 1947. M. S.

1282. Refiners Report Huge Expansion—Building, On Order and Planned. R. B. Tuttle. *Oil Gas J.*, 20.5.48, **47** (3), 161.—Refinery construction projects for the U.S.A. are listed, capacity rating, status, completion date, and contractors being shown. A table shows 565,000 b.d. more crude charged to refineries first quarter 1948, an overall increase of 11·8%. G. A. C.

1283. Bunker Fuel Prices. Anon. *Motor Ship*, June 1948, **29**, 83.—The usual *Motor Ship* data are given on the price of boiler and diesel bunker oils at eight ports, in 1939, 1947, and 1948. It is interesting to note that present quotations are more than three times those of 1939. I. G. B.

1284. Refresher on Statistical Analysis Applied to Two A.S.T.M. Oil Dielectric Strength Test Procedures. E. W. Greenfield. *A.S.T.M. Bull.*, Dec. 1947, **149**, 89–94.—The value of statistical methods as set forth in the A.S.T.M. Manual on the Presentation of Data is emphasized and their application to oil-breakdown-strength tests are described. J. G. H.

BOOKS REVIEWED AND RECEIVED.

U.O.P. Laboratory Test Methods for Petroleum and its Products. 3rd Edition. Chicago: Universal Oil Products Co. $14.00.

This well-known laboratory manual describes methods of test for petroleum and its products used in the Riverside Laboratories of Universal Oil Products Company. It is supplementary to the A.S.T.M. methods of analysis of petroleum and its products.

All the methods described have been selected for the small refinery laboratory and do not require elaborate apparatus or special equipment. They have been carefully selected and thoroughly tested in the U.O.P. laboratories.

The book is divided into eleven sections dealing with: (*a*) analytical procedures; (*b*) asphalt and road oil; (*c*) coal shale and lignite; (*e*) crude oil; (*f*) fuel oil; (*g*) gas; (*h*) gasoline; (*j*) kerosine and diesel fuel; (*k*) lubricating oils; (*l*) solvents; (*m*) catalyst.

These sections include a number of test procedures, such as litharge in doctor solution, fluorine in hydrocarbons, determination of dissolved aluminium chloride in liquid butane, "PONA" (paraffins, olefins, naphthenes and aromatic hydrocarbons) analysis of gasolines, etc., in common use but not so far included in either the standard methods of test of the Institute of Petroleum or those of the A.S.T.M. Committee D.2. For each test the scope of the method is reviewed, the procedure of test given in detail and the calculation outlined with relevant factors. Adequate literature references are also given. Where necessary, precautions for satisfactory operation and safety are given and the limits of accuracy and reproducibility are included.

Earlier editions of this manual made very interesting reading since the introduction of new processes or products into the industry was followed by the appearance of new test procedures in the U.O.P. manual. The current edition, however, shows very little change from the 1943 edition, there being no new methods included and none deleted. The latter is somewhat surprising as one might have expected that such a useful procedure as the "PONA" analysis of gasolines and petroleum naphthas would have been included in the A.S.T.M. methods of test and so become outside the scope of the U.O.P. manual.

The book is excellently produced, well printed on good quality paper and attractively bound—although the reviewer prefers the older editions with loose leaf binding—and singularly free from typographical errors. F. M.

Natural Gasoline and The Volatile Hydrocarbons. G. G. Brown, D. L. Katz, G. G. Oberfell, R. C. Alden. Oklahoma: Natural Gasoline Association of America. 1948. Pp. 92. $4.00.

This booklet summarizes the properties of the volatile hydrocarbons with an ample bibliography of 144 references.

Chapter I deals principally with the various factors concerned in PVT relationships. It also includes tables dealing with the physical properties of the various series of hydrocarbons and a number of graphs showing density variation with temperature for the simpler hydrocarbons. Fluid densities are dealt with in the next chapter, together with a series of charts showing the compressibility factor z or μ plotted against pressure for hydrocarbons up to heptane. The third chapter deals with vapour pressure of different hydrocarbons from other data which may be available. The final chapter on critical properties deals with methods for the calculation of critical pressure, critical temperature of hydrocarbons and hydrocarbon mixtures.

The whole book is a most valuable and useful reference for the physical properties of the more volatile hydrocarbons, as it includes no less than 67 charts plotted on a large scale, together with 25 tables of properties. F. H. G.

Diesel Fuel Oils. New York: American Society of Mechanical Engineers. 1948. Pp. 128.

This book contains three lectures on diesel fuel oil given at the nineteenth A.S.M.E. National Oil and Gas Power Conference on May 20, 1947, together with the discussion. The first two are concerned with the production and characteristics of diesel fuel oils and represent a description by chemists of the refining, physics and chemistry of these oils, prepared for presentation to a mechanical engineering audience; they attempt much and are too diffuse to be of any real value. The discussion of these two papers appears to be haphazard and does not lead to any worthwhile conclusions. The third lecture, however, on the combustion of diesel fuel oils by Martin A. Elliott, of the Bureau of Mines, does present a useful, comprehensive description of the processes involved in the combustion of diesel fuels, including, for example, spray penetration and velocity and the kinetics of the reaction in the auto-ignition of hydrocarbons. Finally, there is a general discussion of the work done on cetane ratings of different fuels and an account of the products of combustion relating also to smoke production.

There are a rather larger number of minor errors in the text of this book than is normal. One repeated throughout the book is the spelling of Sir Alfred Egerton's name as Edgerton, which occurs not only in the text but also in the references.

F. H. G.

The Geology of Venezuela and Trinidad. R. A. Liddle. 2nd edition. New York: Paleontological Research Institution. 1946. 890 pp. $10.00.

This second edition of Liddle's standard work has been critically reviewed by E. Mencher in the Bulletin of the American Association of Petroleum Geologists, March, 1948.

Though geologists familiar with Venezuela, or parts of it, may disagree in many respects with some of Liddle's statements, it must, nevertheless, be admitted that this greatly enlarged edition is still the only publication dealing with the geology of Venezuela in a comprehensive way.

The liberal quotations from the most important publications on the geology of Venezuela are of great help to the student barred from ready access to a major technical library. Liddle's own field observations will still be consulted by geologists interested in geological details and for this reason the publication is to be considered a source for original information.

H. G. K.

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Oilfield Exploration and Exploitation.

Geology.

1285. Isopachous Maps of Sand Reservoirs. J. B. Wharton, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1331–1339.—Methods are outlined for the construction of isopachous reservoir maps as a preliminary to the determination of hydrocarbon reservoir volumes. E. N. T.

1286. The Concept of the Sedimentary Basin, an Essential Feature in Guiding the Search for Oil. M. Bruderer. *Bull. Ass. franç. Tech. Pétrol.*, Apr. 1948 (68), 1–18.—The location and dimensions of the principal sedimentary basins in North America, South America, Russia, the Middle East, and North Africa are indicated, and the sites of the main fields are shown. When there is free choice of exploratory areas the various possibilities with regard to oil accumulation in a basin can be covered. If there is restriction, development may be impeded. A knowledge of the vertical dimension is essential, and this is best determined by well-distributed wells. G. D. H.

1287. Artesian Salt Formations. B. Willis. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1227–1264.—This is a comprehensive study of the salt domes of the Gulf Coast area of the U.S.A. The concentration of salt is attributed to evaporation of inland seas, chiefly during Permian times, when arid climates prevailed in the interior of North America. The possible causes of aridity are discussed and actual occurrences of salt brines described.

The origin and the mechanics of salt domes are considered as explained by the prevailing hypothesis of sedimentary origin, coupled with an artesian hypothesis. The latter substitutes artesian flow for load mechanics as the cause of development of salt domes and considers atomic forces as responsible for the growth of the structures. Any salt dome is hypothetically regarded as an intrusive mass, which receives additions to its volume, molecule by molecule, from brines that rise from warmer to cooler horizons and reach the saturation point. The force of growing crystals is regarded as the cause of upthrust of the dome and of the crushing of the salt itself. The presence of anhydrite is explained as due to crystallization in the order of insolubility, whereas the absence of potash salts is the result of their greater solubility. E. N. T.

1288. Correlation of Sentinel Butte Shale in Western North Dakota. R. W. Brown. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1265–1274.—New stratigraphic and palæontological evidence is considered to indicate that the Sentinel Butte shale, previously thought to be of Wasatch (Eocene) age, is, as originally described, part of the upper Fort Union formation (Paleocene). A diagrammatic cross-section gives the author's correlation of formations in the Paleocene and Eocene series of Eastern Wyoming, Montana, and the Dakotas. E. N. T.

1289. Development and Exploratory Trends in the Rocky Mountain Region. C. M. Boos and L. Brundall. *World Oil*, Feb. 1948, **127** (10), 107.—Intensive oil exploration in the Rocky Mountain area began in 1914, and in ten years most of the visible structures along the foothills were mapped and tested. Now search has extended to the middle of the intermontane basins where the subsurface structure is determinable by geophysics. Formerly unwanted crudes can now be refined, and in recent years much new production has been obtained by deepening in shallow fields.

Deep drilling has given oil and gas production at Church Buttes (Southwest Wyoming) and at Worland and Neiber (southern Big Horn Basin). Favourable

results have been obtained in deep drilling on the flanks of the Big Sand Draw structure (Wind River Basin). Three small Madison limestone pools have been found at the northern end of the Cut Bank field where the Jurassic is the main producing horizon. At Utopia a large gas well was completed in the Devonian. East of Utopia a series of small structures extend towards the Bowdoin Dome. Two small but prolific fields have been developed by drilling to the Ellis at Cat Creek.

In the Powder River Basin encouraging shows have been obtained in the Adon Block in the north. The shallow Mush Creek field was recently opened on the eastern edge, and is a stratigraphic trap. Only small structures have been detected seismically in the centre of the basin. In the centre of the Big Horn basin at Worland, commercial production has been found in the Embar, and at South Fork and Sand Creek in the Embar and Frontier. Winkleman, Sheldon, and Steamboat Butte are recent developments in the Wind River Basin.

Tensleep production has been found in the Quealy field of the Laramie Basin. The Bison Basin structure has yielded encouraging shows of oil and gas.

Deep tests have been drilled to the Weber sand in several fields in the eastern end of the Uinta basin and in the southeast extension of the Green River basin. At Meeker, Iles, Moffat, Beaver Creek, Yellow Jacket, and Poose Creek the Weber sand has proved unfavourable. A large sour-gas reserve has been found in the Pennsylvanian on the Barker Dome at the western end of the San Juan Basin. G. D. H.

1290. Oil and Gas Possibilities of Southwestern Tennessee. C. A. Moritz. *World Oil*, May 1948, 128 (1), 160.—The most favourable area is in the southern part of West Tennessee between the Tennessee and Mississippi rivers. The outcropping beds are Upper Cretaceous to Recent in age, and the trends northeast–southwest. The oldest rocks are in the east. Unconformably below the Upper Cretaceous are Palæozoic rocks, about which little is known, but they are potential oil-bearing rocks. The youngest of these Palæozoic rocks are Mississippian. Cambrian, Ordovician, Silurian, and Devonian rocks are believed to be present. There were several periods of folding in the Palæozoic. The Mesozoic and younger formations were deposited by a sea encroaching from the south. A profound unconformity separates the Cretaceous and Eocene, and these rocks dip west at 15–40 ft/mile. Folds are likely to exist in the buried Palæozoic rocks, and a broad east–west fold in the younger rocks has been noted in central Carroll County. The latter may overlie a Palæozoic structure.

A number of wells have been drilled, and shows of oil and gas are reported from several Palæozoic and Mesozoic horizons. Stratigraphic as well as structural traps are possible, but the discovery of large fields seems unlikely. Surface mapping is not very helpful and subsurface studies, coupled with geophysical work, seem necessary. G. D. H.

1291. Canada's Leduc Field Grows in Importance. Anon. *World Oil*, Feb. 1948, 127 (10), 227.—At Woodbend, northwest of Leduc, gas and 40-gravity oil have been obtained in a drillstem test at 5265–5295 ft from the Devonian D3 zone. Shallower tests have given distillate. There appears to be a saddle between Woodbend and Leduc.

Leduc covers 8100 acres and has proved reserves of 80–120 million brl. Over thirty-five wells produce from the D2 and D3 zones of the Devonian. Intial outputs have ranged 500–2500 b.d.

Pincher Creek 1, in testing the Madison at 11,755–11,800 ft, has flowed gas, and had a closed-in pressure of 5775 p.s.i. Some light oil was recovered.

In Ontario, 5 miles southwest of Tilbury, a well has given 300,000 cu. ft. of gas and 144 b.d. of 38-gravity oil from 1169 ft. G. D. H.

1292. Correlation and Palæoecology of Tertiary Cipero Marl Formation, Trinidad, B.W.I. R. M. Stainforth. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1292–1330.—The author defines the Cipero marl formation by reference to a type section south of San Fernando, Trinidad, B.W.I., and discusses the grounds for division into Lower (Paradise) and Upper (Cacatro) members. Fossil evidence leads to the belief that the period of deposition of the Cipero formation coincided fairly closely with the Oligocene. The stratigraphic relations between the Cipero and other formations of the Naparima Basin are described, and the probable milieu of deposition of the Cipero formation is

discussed. It is concluded that the formation is an open-sea deposit of Globigerina-ooze type, mostly laid down at depths of 400–500 m. The Cipero formation is a close equivalent in age and facies of the topmost Oceanic marls and younger marls in Barbados. E. N. T.

1293. Re-establishing Trinidad Reserve. Anon. *World Oil*, Feb. 1948, **127** (10), 200.—During the first half of 1947 Trinidad produced 10,068,829 brl of oil, and the 1947 output is estimated to have been 20,344,494 brl.

During 1947 the Penal field was extended to the west and southwest, and has been connected with the Wilson field to the northeast. There are indications of good production on the Wilson south flank. A new area has been developed north of the Guayaguayare field on a geophysical structure.

Gas injection is being undertaken at Forest Reserve and Guayaguayare. G. D. H.

1294. Geological Observations of Curaçao, N.W.I. H. P. Schaub. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1275–1291.—This is a summary of the geological history of the island of Curaçao in the Lesser Antilles. The examination of the Pleistocene coral limestones and the outstanding dip slopes formed by them lead to the conclusion that dip slopes represent the original dip of coral reefs rather than evidence of folding. Several stages of uplift and subsidence are connected with the formation of the coral limestones. Two upper Eocene formations, one of them new, are described, and an attempt is made to correlate the geological histories of Curaçao and Western Venezuela. E. N. T.

1295. Venezuela's Limestone Pay Fields Step up Activity. G. O. Ives. *World Oil*, Feb. 1948, **127** (10), 195.—Both La Paz and Mara give promise of producing over 5000 b.d./well. Western Venezuela now produces about 900,000 b.d. mainly from the Bolivar Coastal fields, and late in 1947 La Paz and Mara were giving 147,000 b.d., 145,000 b.d. being from eighteen Cretaceous wells.

South of the La Paz and Mara fields Richmond holds 4,199,000 acres of exploration concessions on which there has been gravity and seismic work, and some drilling. It is believed that two of the wells have located structures and are capable of producing. Five out of seven wells exceed 10,000 ft, and one was tested below 14,000 ft.

La Paz is anticlinal and initially produced from the Eocene at 1900–3000 ft. Cretaceous limestone production was found in 1945. The pay is 1800–2000 ft thick, and no water has been found. The structure runs northeast–southwest. Average completion depths are at about 8000 ft. Gas–oil ratios are 400 to 1 to about 600 to 1, and the oil is 30-gravity. Average producing rates are 10,000 b.d.

The Mara field has eight wells, and conditions are essentially the same as at La Paz, but deeper. Acidization has given encouraging results.

A Cretaceous test is being drilled at Concepcion, where there are ninety-five small Guasare producers. G. D. H.

1296. Saint Gaudens Gas Fields Important to French Economy. E. N. Tiratsoo. *World Oil*, Feb. 1948, **127** (10), 212.—Southern France produced about 6,000,000 million cu. ft. of gas in 1947, and only 30 b.d. of oil. The St. Marcet field was found in 1939 in a Middle Cretaceous dolomitic breccia; a little oil was found in a Jurassic dolomite at 5500 ft. The structure is a diapiric and includes unconformities. To the east are the Proupiary and Saint Martory domes. An 11,000-ft wildcat at Puymaurin has had oil and gas showings. St. Marcet has seven producers. The wells are 9000 ft deep. The cumulative production is 11,134,666,800 cu. ft.

Plagne 3, southeast of Aurignac, has had non-commercial shows. G. D. H.

1297. The Potassium Basin of the Landes and the Likelihood that it May Likewise be Oil-bearing. V. Charrin. *Chim. et Ind.*, 1948, **60**, 194–195.—A deposit of potassium and magnesium salts exists at Boudigot (Landes), being mainly situated at a depth of 700–900 m; preliminary working has been started of some of the deposits lying at a shallower depth. Arguing from evidence obtained at the similar Stassfurt deposits, it is suggested that an oil-bearing stratum may lie below the salt beds, and it is urged that exploration for oil be made in the potassium-rich areas of Southwest France. V. B.

1298. Egypt's Sudr field Arouses New Hope. Anon. *World Oil*, Feb. 1948, **127** (10), 199.—Reserves at Sudr have been estimated at 40 million brl, more than those of the Hurghada field. Ras Gharib is said to have proved reserves of 150 million brl. Sudr has five producers. Production is from the Miocene and Eocene, and is obtained from depths down to 7029 ft. An effective water drive is thought to exist.

Wildcats have been drilled on Tawila and Um el Feysan islands, Feysan I finding basement at 3992 ft and Tawila 2 being in the Miocene at 6695 ft.

Geophysical work has recently been in progress in various places, including the Gulf of Suez.

Abu Roash 1 had moderate showings and was completed in the Jurassic.

G. D. H.

Geophysics and Geochemical Prospecting.

1299. On the History of Geophysical Exploration. H. Lundberg. *Canad. Min. metall Bull.*, 1948, **41**, 171–185).—The historical development of the various methods of geophysical exploration is reviewed. Written from the point of view of the search for orebodies rather than that of the search for oil, the magnetic and electrical methods are treated in some detail, while the gravitational, seismic, and radioactive methods are discussed only briefly. Mention is made of the geochemical, geobotanical, and glacial geology methods of prospecting. A list of references is appended.

R. G. M.

1300. Economics of Aerial Magnetics. C. J. Deegan. *Oil Gas J.*, 22.7.48, **47** (12), 67.—Contrary to general belief small-scale aerial magnetic surveys are economically feasible. Certain precautions are necessary, however. To keep the ratio productive time : total time as high as possible, plan a series of small areas involving only short moves between jobs. Another point is to select a season when interference by bad weather will be at a minimum. Surveying by shoran is not economic for small tracts and hence aerial photographs or accurate geographical maps are necessary to correlate magnetic and geographical features. C. G. W.

1301. New Surveying Method. C. J. Deegan. *Oil Gas J.*, 17.6.48, **47** (7), 58.—This method of radio surveying is known as Lorac. The method locates a station by measurement of the phase difference of two radio waves from fixed stations. Three fixed broadcasting stations are used and it is possible to draw two series of intersecting lines giving two sets of hyperbolas. One set is the series where waves from the central and left-hand station are in phase, the other where waves from the central and right-hand station are in phase. The geographic positions of these lines are found mathematically. To find the position of a mobile station two phase meters are used in conjunction with a counting device. The counters have numbers corresponding to the lines of the intersecting hyperbolas, and the phase difference gives the position of the station. Medium frequencies and wavelengths are used so that the station may be below the horizon, and the equipment is more or less standard and is not subject to the electrical difficulties of high-frequency–high-voltage systems.

Details of operation and of equipment are described. C. G. W.

1302. Tracing Wildcat Trends with Radon Emanations. R. A. Stothart. *World Oil*, Feb. 1948, **127** (10), 78.—Radon emanation surveys embracing productive and dry wells may be of value in guiding exploratory drilling. A sharp jump in the time relationships is claimed to occur at the margin of the producing areas. Fault trends as well as shorelines can be traced by this means. G. D. H.

Drilling.

1303. Humble's Offshore Drilling Programme. K. M. Fagin. *Petrol. Engr*, June 1948, **19** (9), 36.—With one well drilling at 8000 ft from the largest drilling platform yet built and smaller drilling platforms built for taking other leases, the Humble Oil Co. is starting an extensive development of offshore leases. The first platform is double decked, 100 ft wide × 206 ft long, decks 32 and 46 ft above sea-level, cost $1,200,000.

Future offshore operations will be from smaller platforms in conjunction with a drilling barge. Details of construction, design, etc, of the platform are described.

C. G. W.

1304. Michigan's Deepest Test Well. W. E. Schoeneck and T. A. Steele. *Oil Gas J.*, 29.7.48, **47** (13), 219.—This well drilled to 11,012 ft is the deepest in Michigan. One of the major factors in determining the programme was the potentiality of abnormally high formation pressures. Details of the drilling programme are described. Points of interest are the addition of sodium chromate as a corrosion inhibitor and the use of plastic-coated drill-pipe to reduce corrosion fatigue. C. G. W.

1305. Turbine Drill for Rotating Rock Bits. G. Weber. *Oil Gas J.*, 3.6.48, **47** (5), 58.—This turbine drill measures 30 ft length, 10¼ in outside diameter, weight 9000 lb. The 90-stage axial-flow turbine drives the bit without reduction gears. Peak power is developed at 225–250 r.p.m., circulation rate 375 g.p.m. of water + 0·5% aquagel. A preliminary field test was made to 1132 ft at which point 4½-in drill pipe proved insufficient to deliver the required power. Excluding the last section, drilled with an underpowered turbine, the drilling rate was 2·3 ft/min.

Full-scale drilling tests are planned. C. G. W.

1306. Relation of Nozzle-fluid Velocity to Rate of Penetration with Drag Type Rotary Bits. J. P. Nolley, G. E. Cannon, and D. Ragland. *Petrol. Engr*, June 1948, **19** (9), 86.—See Abstract No. 1105 (1948).

1307. Drilling Stresses in Cable-Tool Operations. Part 2. J. F. Kendrick. *Oil Gas J.*, 1.7.48, **47** (9), 56.—A drilling cable consists of a number of open-coil helical springs assembled adjacently. Intermediate and deep-drilling are essentially problems in vibration of the string. The natural vibration of the cable reduces the tension locally in the cable at some point below the clamp. This causes a localized working of the strands of the cable as the reduction in tension occurs where the cable is partly untwisted. The condition is relieved by the use of swivel sockets, long strokes, tapered drilling cable, and preformed cable. C. G. W.

1308. Diamond Coring in the Rangely Field Colorado. C. J. Christensen. *Petrol. Tech.*, Jan. 1948, **11** (1), *A.I.M.M.E., Tech. Pub. No.* 2301, 1–13.—Diamond coring of the Weber sand at Rangely was instituted in 1946. The normal technique cuts a 6¼-in hole and obtains a 3¼-in core, while reverse circulation coring cuts a 4¾-in hole and a 2¾-in. core. A 50-ft core barrel is now used in the former technique, and in extraction the core is broken off in 4-ft lengths.

The Weber sand consists of hard, dense dolomite and dolomitic sand, hard grey shale, red shale, sand and sandy shale, and quartzitic sandstone. The coring rates range from 30 min/ft in hard shales to 5 min/ft in true porous sandstone. The average footage per bit exceeds 200 ft and has reached 721 ft. Core recovery is very high.

Diamond-core equipment and the technique are described in some detail, with an analysis of costs and times.

The Weber is about 6000 ft deep and therefore trip time is high. Reverse-circulation coring offsets this, and a single bit in one trip cored 399 ft, of which 392 ft was washed to the surface and recovered. The core should be broken off in about 3-ft lengths.

Experienced personnel are necessary in diamond coring. G. D. H.

1309. Flexible Hose in Rotary Drilling Operations. L. Cranston and R. Leonard. *Oil Gas J.*, 3.6.48, **47** (5), 62.—To obtain maximum hose life attention should be paid to the installation, care, and use of hose. Trouble with hose usually occurs by kinking or rupturing near the ends. This is due to too short a hose length for the standpipe height and tool-string height. Other points to consider are the standpipe-elbow angle and the avoiding of backtwisting and excessive-pressure pulsation and all unnecessary and harsh treatment during installation, use, and removal. C. G. W.

1310. Electrical Logging Developments in the U.S.S.R. Part 3. The Equivalence Principle. H. Guyod. *World Oil*, Feb. 1948, **127** (10), 84.—Under certain conditions

approximate coincidence may be obtained for a series of departure curves. The ratio of the diameters of the mud-invaded zone and the hole must be between 1·2 and 4. This equivalence principle permits the use for a given resistivity distribution of a departure curve established for a different distribution. The possibilities of the use of the equivalence principle are discussed, although it is noted that in the past the range of electric logs obtained has not been sufficient for its application. With suitable logs the hole diameter may be determined. G. D. H.

1311. Electric logging developments in the U.S.S.R. Part 4. Interpretation of Resistivity Data by Full Curve Matching. H. Guyod. *World Oil*, May 1948, **128** (1), 124. —In order to obtain the true formation resistivity with a single electrode spacing when there is the possibility of mud-invasion, the spacing should be at least fifty times the hole diameter. Even this is not entirely satisfactory, and it is preferable to have measurements with several small and moderate spacings with subsequent matching with precalculated departure curves. The latter technique gives good results if the formation is reasonably uniform. If the mud resistivity, resistivity, and diameter of the mud-invaded zone and well diameter are not known, measurements with five electrode spacings will be needed to obtain the true bed resistivity. When sufficient data are available, some of the above unknowns can be calculated.

The general form of the departure curves is given for the various relations between true bed resistivity, mud resistivity, and resistivity of the invaded zone. Curve matching is discussed, and the types of inferences which can be made are enumerated. In practice there may be limitations which preclude the accurate determination of some of the factors, although limiting values may be derived. This point is elaborated. The curve-matching technique is limited by the lack of sufficient departure curves for all cases.

The possibility is considered in which approximate methods of interpretation would be used employing principles set forth by Hummel and Maillet in surface electrical exploration. G. D. H.

1312. "Red" Mud Behaviour. C. R. Houssiere, Jr. *Oil Gas J.*, 24.6.48, **47** (8), 180.—Basic constituents of "red" mud are: (1) caustic; (2) quebracho; (3) starch; (4) lime. The fundamentals of mud behaviour are briefly discussed. So-called "red" muds are less liable to flocculation in the presence of salt water than normal muds. Two theories are held: (1) the conversion of a "Na" Bentonite to "Ca" Bentonite tending to prevent gelation, etc; (2) the protective possibilities of starch. The advantages of "red" muds are listed. C. G. W.

1313. Mud Acid and Plastics for Completion and Production Problems. A. C. Polk, Jr. *Oil Gas J.*, 24.6.48, **47** (8), 205.—Development of the use of mud acid on the Gulf Coast is described. The main uses are to (1) increase permeability; (2) remove drilling fluids; (3) clean completion apparatus; (4) clean the critical zone; (5) open perforations; and (6) loosen stuck drill pipe.

Plastics are used mainly for: (1) excluding undesirable fluids—the plastic is applied to the formation as a liquid with suitable catalysts to retard setting, by a squeeze technique; (2) bonding unconsolidated formations. For this purpose the plastic must penetrate the formation at low pressure, possess adequate compressive and tensile strength, and when solid exhibit inherent permeability. Factors and problems to be considered in the application of plastics are also mentioned. C. G. W.

1314. Drilling Mud. J. Wojcik. *Nafta*, Feb. 1948, **4**, 45–48; Mar. 1948, **4**, 87–91; Apr. 1948, **4**, 128–132; May 1948, **4**, 169–171.—In rotary drilling, the composition of mud is of primary importance. At depths greater than 1500 m the problems of mud are more important than any other. Chemically, muds are compounds of Al, Si, O, + Ca, K, Na, etc. Microscopic, X-ray, and centrifugal separation enable differentiation between three groups: sand >0·074 mm, mud between 0·074 and 0·001 mm, and colloids below 0·001 mm. All these are present in drilling muds. With small diameters, large areas are usually associated and physical surface forces have greater effect than chemical forces. The weathering of parent rock means that the ratio $SiO_2 : Al_2O_3$ is lowered. Where that occurred chemical bonds are stronger, and colloids are difficult to obtain. Different muds show different affinity to water,

Similar discrimination is shown towards different ions. A cell can be constructed to prove this point. The laws of mass action can be applied here. Reactions similar to this: (mud — Ca) + 2NaOH = [mud — 2Na] + $Ca(OH)_2$ show how chemical reagents can influence dispersion. Lately it has been discovered that there are more important factors than pH.

Main physical properties are density, viscosity, tixotropy, coagulation, and filtration. Natural mud of density about 1·25 can be made heavier using hæmatite or $BaSO_4$ or galena. Muds are non-Newtonian fluids and their viscosity depends on the velocity. Viscosity is also decreased by adsorption of ions, but care must be taken to see that increase of gravitational attraction does not completely spoil viscosity decrease due to electrical repulsion.

When the electrolytes are used, care must be taken that they are not decomposed by temperature rise (phosphates). Electrolytes have a marked influence on tixotropic properties. There is no proved theory explaining this. Temperature increase lowers the speed of solidification after the circulation has stopped. Viscosity and such solidification are inter-related. Coagulation may be caused by disappearance of electric charges and leads to sedimentation. It may also be caused by excess of H^+, NaCl, and temperature rise.

Filtration is the most important property of muds. It causes migration of water into formations and deposition of solids on the walls. This property is improved by great variety of particle size present in a mud. This property can be easily tested in a laboratory, and quantitatively correlated on a chart.

Drilling mud should be constantly tested for sp. gr., μ, consistency, caking, pH, and sand content. Sp. gr. is usually found using Baroid balance, μ by Marsh Funnel, consistency by Schirometer, caking by using a low-pressure pump, pH by indicators, and sand content by a Baroid instrument. Chemicals added to muds can correct viscosity, μ, and caking, and can also give special muds. Chemicals are classified as electrolytes and colloids. Amongst the first are sodium hydroxides, carbonates, silicates, and phosphates; among the others tannin, sulphocellulose, humic-acid salts, starches, sulpho acids and salts, and crude oil.

In the U.S.A. there have been introduced "muds" where the liquid phase is crude oil and the dispersed solid is blown asphalt. Viscosity can be adjusted using pine resins and Na_2SiO_3. This new "mud" is very good for drilling through low-pressure oil-bearing sands, but it is expensive and inflammable. Water exuding from the sand is an undesirable impurity.

Special difficulties frequently occurring are: (*a*) contamination of mud by concrete, calcites, salt, and sand; (*b*) where the fluid from formation is at high pressure and causes explosion, or at low pressure and mud enters formation, and (*c*) when oil-bearing sands are passed. Modern means of dealing with these problems are given. Initial steps used in the U.S.A. and the U.S.S.R. for preparation of mud are briefly described. Appended are titles of Russian and American books on the subject of muds. M. S.

1315. Worldrop Portable Drilling and Servicing Rig. Anon. *Petrol. World*, Feb. 1948, **45** (2), 28.—The unit, by Worldrop Eng. Co., has 96-ft telescoping derrick, capacity 7500 ft with 3½-in drill-pipe. 350-h.p. diesel at 1800 r.p.m. gives rotary and hoisting power. The unit is approx. 20,000 lb lighter than normal unit, extensive use of aluminium shapes, plates, and sheets, and alloy steels being responsible. Other features are also described. C. G. W.

1316. Track Wheel Units for Moving Rigs. L. S. McCaslin, Jr. *Oil Gas J.*, 15.7. 48, **47** (11), 72.—This method, whereby the rig is moved in two units without dismantling, has now extended to Oklahoma. The rig is supported on four track-wheel units, each supporting a swivel carriage on it. Actual moving time for a ¼-mile shift was 2 hr, and the entire job was completed in 10 hr. C. G. W.

1317. Safe Practices in Using Fibre Rope. D. Attaway. *Petrol. Engr*, July 1948, **19** (11), 47.—Practices in the care and use of fibre rope are outlined. Main points are: (1) avoid kinking; (2) keep clean and store carefully; (3) avoid abrasion and contact with rough or sharp surfaces; (4) inspect frequently and thoroughly; (5) use only accepted methods of knotting. C. G. W.

1318. Dielectric Properties of Oil Sands. R. T. Wheeler. *Petrol. Engr*, June 1948, **19** (9), 141.—The paper is the result of research on the dielectric properties of oil sands at radio frequencies. The properties dealt with are dielectric constant and the dissipation factor. Important properties for further investigation are dielectric loss, the loss factor, power factor, A.C. and D.C. conductivity and electrical breakdown strength. It was hoped that the work would provide a basis for further research into secondary recovery methods. Experiments were carried out on synthetic sands to determine the more important factors.

Equipment used consists of a signal generator, radio-frequency bridge, and a detector. A signal is put through the bridge, and when the bridge is in balance no signal is heard from the detector.

Details of the equipment used, operating methods, and basic theory are described. The work is not extensive enough as yet to give conclusive results. C. G. W.

Production.

1319. Mechanical Cleaning of Wells. III. B. Grant. *Prod. Monthly*, June 1948, **12** (8), 26.—A further article in the series on " oil-well reconditioning in S.W. Pennsylvania " deals with preparing the well for clean-out, casing-repair methods, clean-out tools, combatting caving, shot-hole cleaning, and cleaning with compressed air. References are appended. C. G. W.

1320. Shooting in Conjunction with Cleaning Out of Wells. B. Grant. *Producers' Monthly*, July 1948, **12** (9), 23.—Part IV of " oil well reconditioning in S.W. Pennsylvania District " deals with shooting practices in the area. Details of the explosives and the procedure used in jobs in this area are given, and the effects of the explosives discussed. References are appended. C. G. W.

1321. Dry Ice Bailer for Clean-out Operations. L. S. McCaslin, Jr. *Oil Gas J.*, 29.7.48, **47** (13), 258.—The basis of this operation is that dry ice evaporates rapidly in water, building pressures up to 1000 p.s.i. if confined. The bailer consists of a dry-ice chamber and a water chamber connected by a petcock. 45 lb of dry ice are used and the petcock opened. After a 30-min wait the tool is lowered down the hole and jarred on bottom to open four ports. A strong jetting action occurs for a period of 5–10 min. Cavings are then bailed out by a sand bailer. C. G. W.

1322. High Pressure Practices on Gulf Coast. L. S. McCaslin, Jr. *Oil Gas J.*, 24.6.48, **47** (8), 169.—Taking Phillips Co.'s methods as an example, production practices of the district are described. Typical drilling and completion data are given. Each gas-distillate producer has its own tank battery. Two-stage separation is used for both distillate and oil wells. A 9% nickel tubing has been developed in an attempt to combat corrosion. Safety features, water disposal, and testing procedure are briefly dealt with. C. G. W.

1323. Cycling Plant for Small Fields. L. S. McCaslin, Jr. *Oil Gas J.*, 24.6.48, **47** (8), 198.—There is a trend towards installation of mechanical separators for small condensate fields. In the latest of these, three-stage separation is used to extract liquid hydrocarbons. Points of interest are : (1) high injection pressure—5200 p.s.i. ; (2) all excess gas injected—no loss ; (3) on one compressor two-stage compression is effected in one cylinder. Other points of interest are noted, and flow sheets and photographs illustrate the article. C. G. W.

1324. Gas Lifting Low-fluid-level Wells. A. C. Golden. *Oil Gas J.*, 24.6.48, **47** (8), 217.—Normally gas-lifting of low-level wells use an excessive quantity of gas. To overcome this an accumulation chamber was designed which would give a greater amount of fluid lifted per lead of input gas. A double-packer volume chamber was used. Input gas is introduced into the chamber by a pressure-control valve, through a bypass in the packer. A differential valve closes and fluid in the annular area of the chamber is displaced into the tubing through a perforated nipple. The standing valve prevents fluid from re-entering the formation.

As the head of fluid increases in the tubing the differential valve opens and aids in unloading. When the cycle is completed, the differential valve opens, the pressure-control valve closes, and the pressure drops, permitting fluid to enter from the formation.

Use of this chamber gave production of 120 b.d. with an input gas : oil ratio of 1500 : 1. C. G. W.

1325. Co-operative Gas Injection in West Texas. K. B. Barnes. *Oil Gas J.*, 1.7.48, **47** (9), 52.—A twenty-year gas-injection programme will increase ultimate production by an estimated 50%. Thirty operators representing 80% of the North Cowden W. Texas field are committed to the programme. The geology and characteristics of the field, proposed operations, and plant and gas systems are discussed. C. G. W.

1326. Gas Conservation Project. G. Weber. *Oil Gas J.*, 8.7.48, **47** (10), 60.—The Seeligson field of Southwest Texas is being unitized except for gas produced directly with oil. Plant operations and cycling plans are discussed. C. G. W.

1327. Closed Gas-lift System. Anon. *Oil Gas J.*, 8.7.48, **47** (10), 62.—The Phillips Co.'s system at League City is described. Gas-lift gas and produced gas are separated from the oil at the tank battery, gas-lift gas returned by compressors to the producing wells and formation gas is available for lease fuel. Features of control and design are mentioned. C. G. W.

1328. Selective Plugging of Input Wells. J. P. Jones. *Producers' Monthly*, July 1948, **12** (9), 19.—In the Bradford field efforts were made to find a permanent plugging agent that could if necessary be dissolved. A substance developed was resin emulsion 236, a stable dispersion. 45% solids, average particle size <1 micron. It is insoluble in aliphatic hydrocarbons and is soluble in dilute alkali solutions. Acid no. is 80. After injecting the resin, water is introduced to carry in to the sand face, after which water intake is reduced to 1 brl/hr. It is postulated that under these conditions the loose sands will absorb all fluids introduced into the well. Details of field tests of the resin are given. Conclusions drawn from the results of field tests are : (1) the method of application gives the desired selectivity ; (2) if overapplied it can be dissolved from the sand face ; (3) application has not lowered production rates below the usual decline ; (4) operating costs reduced in many cases. C. G. W.

1329. Radial Turbulent Flow Formula. J. R. Elenbaas and D. L. Katz. *Petrol. Tech.*, Jan. 1948, **11** (1), *A.I.M.M.E. Tech. Pub. No.* 2304, 1–15.—Although much of the flow towards a gas well may be laminar, turbulent flow may exist in the formation adjacent to the well bore. A radial turbulent flow formula has been derived, and this can be integrated graphically. By this means a complete back-pressure curve can be calculated and compared with observed back-pressure curves. A relationship is provided for computing the permeability of an un-cemented porous medium from the porosity, sphericity, and average diameter of the component particles. Examples of the use of the formulæ are given.

The computed back-pressure curves are found not to be linear, and this is to be expected when the entire curve is not wholly in the completely laminar or completely turbulent region. Thus linear extrapolation to obtain the open-flow rate may be inaccurate. Examination of the formula indicates that for completely laminar flow the back-pressure curve will be straight with a slope of 1·0, while in the completely turbulent region the curve will be straight, but with a slope of 0·5. G. D. H.

1330. Petroleum Production Trends. R. S. Knappen. *Oil Gas J.*, 17.6.48, **47** (7), 79.—Future exploration and drilling costs will increase as depth of producing wells increases. Hence the costs of drilling and production must be kept to a minimum and the total production of wells increased as far as possible. Present trends in drilling are towards turbine or electrical drive for the bit, eliminating power losses due to drill-pipe inertia, and improved mud fluids. Improvements in cementing and casing materials and technique can effect large savings. Production practices which may reduce costs are : centrifugal and hydraulic pumping units, use of surface tension

depressants, corrosion prevention, and the application of secondary recovery in unitized operations. C. G. W.

1331. Calculation of Well Loads and Pump Selection. A. E. Caraway. *Petrol. Engr*, June 1948, **19** (9), 108.—Well-load calculations may be made using either the Slonegger (A.P.I.) or the Mills formula. The Mills formula is generally accepted as more accurate at pumping speeds from 20–25 s.p.m. The author suggests that neither formula is satisfactory for speeds above 25 s.p.m. and that the Mills formula should be modified for such speeds.

Mills formula is

$$P = WO + WR\left\{1 + \frac{(\text{s.p.m.})^2 \times \text{Stroke (inches)}}{70{,}400}\right\}$$

Caraway Modification (25–35 s.p.m.).

$$P = (WO + WR)\left\{1 + \frac{(\text{s.p.m.})^2 \times \text{Stroke (inches)}}{70{,}400}\right\}$$

where P = peak polished rod load lb.
WO = weight of fluids lb.
WR = weight of rod string lb.

Comparisons of these formulæ with experimental dynagraph results indicate that loads given by Mills and Slonegger are too low and those given by Caraway too high at high pumping speeds.

Factors to be considered in rating and selecting prime movers are mentioned. The formula $b.h.p. = \frac{D^2LS \text{ s.p.m.}}{600{,}000}$ where D = pump size, L = depth, and S = stroke length is suggested for selecting a suitable prime mover. For using this formula the A.P.I. rating curve on the engine should be used or the maximum horse-power shown at the correct operating speed multiplied by a factor 0·65 to get the maximum engine capacity for application to pumping loads. C. G. W.

1332. Pumping Periods for Water-flood Wells. T. Canan. *Producers' Monthly*, July 1948, **12** (9), 16.—Several short pumping cycles spread over a day are generally more efficient than one or two longer cycles. Factors to be considered in determining the best pumping periods are: (1) length of standing periods; (2) length of pumping periods; (3) timing of cycle in respect to other wells. Field experiments were carried out to determine the practicability of adjusting the periods of individual wells. Conclusions drawn are: (1) careful determination and balancing of pumping periods for water-flood wells can result in substantial power savings, improved load factors, and maximum production; (2) a recording ammeter is a convenient method for determining periods for wells pumped by individually powered jacks; (3) beam counterbalancing can be closely adjusted by the recording ammeter. The ammeter records current fluctuations during the pumping cycle and indicates the point at which the well pumps off. By noting pump-off times for various standing times the optimum can be found. C. G. W.

1333. Recording Type Meters at Electric Pumping Wells. R. E. Hammond. *Oil Gas J.*, 3.6.48, **47** (5), 62.—Efficient operation of an electric oil-well pumping installation requires knowledge of pumping-load characteristics. Such loads are of a pulsating nature, and hence continuous recording instruments are needed to determine average and peak loads. Wattmeters or ammeters of the inkless type are most useful, a combination of a recording wattmeter, integrating wattmeter, and indicating ammeter giving the best results. From such records, the degree of unbalance and efficiency of the subsurface pump may also be determined. C. G. W.

1334. Secondary Recovery of Oil in Ohio. J. R. Cashell. *Producers' Monthly*, June 1948, **12** (8), 14.—The expansion of secondary recovery methods in Ohio oilfields is discussed. General operating and producing problems are mentioned, and it is concluded that the future of secondary recovery is assured under stable economic conditions. C. G. W.

1335. Location of Points of Water Entry in Oil Wells. D. Silverman and A. R. Brown, *Petrol. Tech.*, Jan. 1948, **11** (1), 1–19.—The point of entry of water into a well is of importance if the water is to be successfully controlled. The equipment employed for this purpose consists of a long pipe-like assembly with ten pairs of electrodes set at 4-ft intervals. A surface-controlled solenoid-operated switch connects each pair of electrodes in turn to a single-conductor armoured cable, and thereby the conductivity of the fluid in the vicinity of each of the electrode pairs can be continuously recorded at the surface. This assembly is lowered on tubing to the section of the well to be examined. A pump inlet is placed below the lowest electrode pair, and a conventional rod-pump is used to produce the well. The salt water standing in the well is pumped out and fresh water introduced into the annulus at the surface until the resistivity of the water in the well has been raised to a suitable value. The drawdown operation of the survey is then begun by pumping out liquid thereby lowering the fluid head in the well, and allowing fluids to flow from the formation into the well. The zones of salt-water entry will be shown by a drop in resistivity at these levels. After pumping is stopped a flush period ensues, and the results obtained during these two phases are readily interpreted.

Data are given on a series of tests conducted with this equipment. The cost of this type of operation is at present about twice that of other water-locating services.

G. D. H.

1336. An Improved Water-input Profile Instrument. R. J. Pfister. *Petrol. Tech.*, Jan. 1948, **11** (1); *A.I.M.M.E. Tech. Pub. No.* 2315, 1–13.—A water-input profile instrument has been devised which locates the boundary between brine and fresh water introduced into an input well. Two methods have been employed in using this instrument to measure foot by foot water-intake rates for the various sands. In the moving boundary method, brine only is first injected to raise the boundary, and subsequently fresh water alone is injected to lower the boundary. In both cases the time for the boundary to travel known vertical distances is determined by the electrode system in the well. The two runs cancel out the effects of variations in well diameter. Both fresh water and brine are injected in the constant boundary method. The injection rates are pre-determined, and the boundary is located after equilibrium has been reached. Each method has its advantages and disadvantages, and these and the detailed techniques are discussed.

Representative data are included showing the use of the instrument in experiments involving selective acidizing, selective plugging, and selective shooting. The instrument is of value in diagnosing unfavourable conditions in the distribution of intake into various strata, and assessing the results of corrective measures. G. D. H.

1337. Analytical Basis of one of the problems of Subsurface Fluid Flow. W. Kulczycki. *Nafta*, Feb. 1948, **4**, 48–52.—Intrusion of water, flooding of wells by underground water before the crude has been extracted, and formation of extending water "tongues" ("tentacles") has been explained by a mathematical theory.

Formulæ

$$\int_0^L V\mu dx = \int_{p_1}^{p_0} Kdp \text{ (D'Arcy)}$$

$$Q = \frac{2\pi \cdot K \cdot b \cdot (P_0 - P_1)}{\mu \cdot \ln \frac{R_0}{R_1}} \text{ (Dupuis)}$$

$$\mu = -\frac{\mu_1 \mu_2 L}{\mu_1 \xi + \mu_2 (L - \xi)}$$

where K = coefficient of porosity of formation.
L = length of particle path.
R_0 = filtration radius.
R_1 = drain radius.
b = thickness of formation.
ξ = distance from the source of pressure to water–crude interface;

are combined to give average velocity of filtration

$$V \text{ av.} = \frac{K(\rho_2 - \rho_1)}{m[\mu_2 L + (\mu_1 - \mu_2)\xi]}$$

where $$m = \frac{V \text{ effective}}{V \text{ average}}$$

μ = viscosity.
P = pressure in all formulæ.

Making different assumptions, Leibenson, Muskat, and Prof. W. N. Shtchelkatchev arrived at various approximate expressions for $\beta = \frac{Tw}{Tc}$ where Tc = time required to expel crude by direct application of pressure and Tw = time required using water lift. Usual values of $\beta = 0{\cdot}29$, but pressures transferred through the medium of water are higher, and so there exists an unstable equilibrium should water–crude interface be not flat. M. S.

Oilfield Development.

1338. Highlights on 1947 Developments in Foreign Petroleum Fields. L. G. Weeks. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1093–1160.—The year 1947 brought a 9·6% increase in world oil production over 1946 and 43% over 1939. These increases result from an increase in the U.S.A. of 7% over 1946 and 47% over 1939, and from an increase abroad of 14% over 1946 and 43% over 1939. Indonesia recorded a 60% increase over 1946, but was still 63% below 1939. Europe and Asia, outside Russia, produced somewhat less last year than in 1946 and considerably less than 1939. Russia increased production by 17% over 1946, but was still 14% below pre-war. Venezuela registered an increase of 12% over 1946 and 112% over 1939.

Of note is the consistently uniform percentage of total world oil produced since 1930 by the Western and Eastern Hemispheres (about 8% and 20% respectively), by the U.S.A. (62%), and by all foreign countries (38%). During the same 18-year period there was a moderate increase in S. America (13·4–17·2%) which was offset by a moderate decrease (66·6–63·6%) in North America. A three-fold increase in the Middle East (3·5–10·5%) was roughly offset by decreases elsewhere in the Eastern Hemisphere.

In both Venezuela and the Middle East the percentage of total world output in 1947 was approximately double the percentage of total cumulative production.

The regional distribution of the world's 70 billion brl of proved reserves is given, with an estimate of the approximate distribution of ultimate potential reserves. These figures result from analytical study of the basin areas of the world.

Cumulative oil production through 1947 and daily averages for 1939 and 1947 for all countries and major world subdivisions are given. The distribution of geophysical effort in crew months is shown, and comparison with 1946 indicates an approximate 20% increase in geophysical study, which is a rough measure of the increase in total exploratory effort in 1947.

A brief outline of the highlights of developments during 1947 for more than sixty countries is given. E. N. T.

1339. Exploratory Drilling in 1947. F. H. Lahee. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 851–868.—This is the third annual report on exploratory drilling statistics in the U.S.A.

In 1947, 6775 exploratory holes were drilled in the U.S.A., of which 3480 were wildcats, 1753 new-pool tests, and 1542 outposts. Among the new field wildcats, 394 were successful; 495 new-pool tests were also successful; and so were 489 outposts.

The total exploratory footage drilled in 1947 was 26,393,348 ft in the 6775 holes (3896 ft per hole). These figures compare with the 1946 statistics of 22,178,864 ft drilled in 5753 exploratory holes, with an average depth of 3855 ft per hole.

E. N. T.

1340. Developments in Arizona, Western New Mexico, and Northern New Mexico in 1947. P. H. Umbach. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 984, 987.—In 1947,

seventeen wildcats were drilled, with a total footage of 53,721 ft in Western and Northern New Mexico, of which two wells were successful oil producers.

Three wildcats were drilled in Arizona, with a total footage of 10,721 ft. None of these tests were commercially productive.

Exploration showed an increase in activity, with eight seismograph crews at work in the San Juan basin, and one crew in the Black Mesa basin. E. N. T.

1341. Developments in Arkansas and North Louisiana in 1947. J. R. Williams. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1040–1064.—In 1947, 1343 wells were drilled in this region, a 34% increase over the 1946 figure. 237 wildcats were drilled, 76 in Arkansas and 161 in N. Louisiana, as against a total of 172 wildcats in 1946.

In Arkansas, four new oilfields were discovered. In addition, one new distillate field, eleven new oil zones in old fields, and two new distillate zones were found. Four new oil zones in old fields, one new gas zone in an old field, and one new distillate zone in an old field were found in N. Louisiana. New fields and new pay zones totalled thirty-five for the area, as against twenty-six in 1946.

Oil production totalled 69,207,010 brl, 7,564,868 brl more than in 1946.

Geophysical activity totalled 705 crew weeks, the seismograph contributing 368 weeks and the gravity meter 188 weeks in Arkansas, while in N. Louisiana crew weeks totalled 1281, with 718 weeks of seismic exploration and 510 weeks of gravity-meter exploration. E. N. T.

1342. Developments in Atlantic Coastal States Between New Jersey and North Carolina in 1947. H. G. Richards. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1077–1078.—Drilling activity in this area declined in 1947. The most significant well was that at Pamlico Sound, North Carolina. This was abandoned at a depth of 6410 ft without any indication of oil or gas. Several other dry wells were drilled. No drilling was reported from the Coastal Plain of New Jersey, Delaware, Maryland, or Virginia. One well was drilled in the Piedmont region of New Jersey, and one in extreme Western Maryland. Activity continued in the Rose Hill Field in South-West Virginia. E. N. T.

1343. Developments in California in 1947. G. B. Moody. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 869–885.—Total exploratory footage in 352 exploratory wells completed in California in 1947 was 1,571,257 ft, as compared with the 1946 figures of 366 wells and 1,584,647 ft. The total number of completions, footage, and percentage of success for the different types of wells were: new field wildcats—188 wells, 787,258 ft, wells 4·8% successful, footage 5·9% successful; new pool wildcats—eighty-four wells, 403,697 ft, wells 26·2% successful, footage 20·1% successful; deeper-pool tests—nineteen wells, 62,248 ft, wells 47·4% successful, footage 33·1% successful; shallower-pool tests—two wells, 7316 ft, wells 50% successful, footage 71·2% successful; outposts—fifty-nine wells, 310,740 ft, wells 50·8% successful, footage 49·2% successful. All exploratory wells were 20·2% successful as to number and 19·5% successful as to footage; the analogous figures for 1946 were 19·1% and 19·4% respectively. Thirty-five new oil pools and six new gas pools were discovered, but none of major importance. The new fields, pools, and extensions added 138,000,000 brl to oil reserves and 178,000,000 million cu. ft. to gas reserves. 1947 production was 336,598,000 brl of oil and 583,600,000 million cu. ft. gas, as against 1946 production of 317,482,000 brl and 532,454,000 million cu. ft. E. N. T.

1344. Cuyama Discovery of the Decade. L. P. Stockman. *Petrol. World*, July 1948, **45** (7), 17.—Current petroleum exploitation is reviewed in this article. Richfield Oil Co.'s discovery in the Cuyama Valley may prove of vital importance and alter present production trends. Sufficient data is not yet available to draw reliable conclusions. C. G. W.

1345. Continental Shelf Development. N. Williams. *Oil, Gas J.*, 24.6.48, **47** (8), 152.—Work is now being carried on at twenty-one different locations along the Continental Shelf. The companies operating and the extent of the work undertaken are briefly described. C. G. W.

1346. Developments in Michigan in 1947. L. W. Price. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 931–939.—Of the 263 wildcats drilled in 1947, twenty were completed as producing wells, resulting in the discovery of ten oilfields and one gasfield. The Kimball Lake, Mount Forest, and Stony Lake fields developed new oil reserves, but the new gasfields were small.

896 wells were completed in 1947 as against 823 in 1946. 318 were oil wells, 191 gas wells, and 387 dry holes. Total footage drilled was 1,990,880 ft, an increase of 5% over the 1946 total, and wildcat footage was 623,499 ft, a 2½% increase.

The oil production in 1947 was the lowest total for five years at 16,215,613 brl. Gas production increased to 23,954,925,000 cu. ft.

Core drilling was the most satisfactory exploration method.

The most important deep test was the Rheinhardt well in the West Branch field, Ogemaw County. It was drilling at 10,600 ft at the end of 1947 with no substantial showings of oil or gas. E. N. T.

1347. Developments in North Mid-Continent in 1947. J. R. Berg. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 940–947.—Fifty-eight oil pools and twelve gas pools were discovered in Kansas in 1947. Although many of the discoveries were outpost or new-pool discoveries, there were ten new-field discoveries.

Iowa, Nebraska, and Missouri showed little development.

Kansas produced 106,000,000 brl of oil and casing-head gasoline in 1947, compared with 98,000,000 brl in 1946. Gas production was 180,000 million cu. ft. against 143,000 million cu. ft. in 1946. E. N. T.

1348. Developments in Louisiana Gulf Coast in 1947. W. B. Neill. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1032–1039.—646 wells of all classifications were drilled in the Louisiana Gulf Coast area in 1947, of which 166 were exploratory wells and 480 field development wells.

Of the exploratory wells, fifty-nine were successful. They can be classified as follows: new-field wildcats seventy-three, 17·8% successful; new-pool wildcats thirty-nine, 64·8% successful; shallower-pool tests seven, 85·7% successful; deeper-pool tests seven, 100% successful; outposts forty 20% successful. There were 480 development wells, of which 82·3% were successful.

There was a 10% drilling increase in 1947, with 646 wells drilled, compared with 586 in 1946.

The thirteen new-field discoveries include seven oilfields, two gas-distillate fields, and four gasfields. Only two of these fields are of significance.

Ten of the discoveries were credited to seismic survey and three to seismic and subsurface.

Seismograph operations continued steadily with an approximate total of 3400 crew weeks reported for the year. Most of these operations were along the coastal and off-shore Miocene trend.

The exploration trend was along the Miocene belt, which offers unlimited prospective sands and promise of greatest returns. E. N. T.

1349. Developments in Pennsylvania in 1947. G. R. Fettke. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 897–906.—A decline of 11% occurred in the number of wells completed in the shallow-sand territory of Western Pennsylvania during 1947, compared with 1946. Sixteen minor gas pools and no new oil pools were discovered. 1840 new wells were completed in the Pennsylvania section of the Bradford oilfield, compared with 2153 in 1946. About half of these were water-intake wells. The Bradford field accounted for 82% of the Pennsylvania 1947 total production. Average daily production in the State in 1947 was 35,242 brl, compared with 36,383 in 1946.

Twenty-eight deeper wells were completed, ten being gas wells, twelve dry holes, and six for gas storage. One gas well opened a new Medina sand pool in Erie County. E. N. T.

1350. Developments in Southeastern States in 1946 and 1947. R. M. Harris and W. M. Payne. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1065–1076.—Wildcatting continued at about the same rate as in previous years, development in established producing areas showing a substantial increase.

Gravity-meter work decreased and caused a decline in geophysical crew weeks worked.

Alabama had a total of twelve wildcats drilled and abandoned in 1946 and twenty in 1947.

In the Gilbertown field three producers and two dry holes were completed in 1946 and one dry hole completed in 1947. Production from this field was 382,903 brl in 1946 and 463,776 brl in 1947.

A total of 839 crew-weeks of geophysical work was completed in Alabama in 1946 and 476 in 1947.

Florida had a total of twenty-one wildcats drilled and abandoned in 1946 and twenty-five in 1947.

In the Sunniland field, two producers were added in 1946, while two producers and one dry hole were added during 1947. 56,863 brl of oil were produced from four wells in 1946 and 259,136 brl from five wells in 1947.

Geophysical crew weeks worked in Florida totalled 535 in 1946 and 249 in 1947.

Three wildcat wells were drilled and abandoned in Georgia in 1946 and five in 1947.

Mississippi had a total of eighty-one wildcats drilled in 1946, which resulted in the discovery of three new fields and four salt domes. Ninety-three wildcats were drilled in 1947, and three fields and five salt domes were discovered. In the established producing areas, 158 producers, and nineteen dry holes were added in 1946 and 340 producers and forty dry holes in 1947.

All Mississippian fields produced a total of 24,296,116 brl of oil and condensate in 1946 and 35,183,838 brl in 1947. E. N. T.

1351. Developments in South Texas in 1947. B. Scrafford. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 997–1008.—Developments in South Texas in 1947 showed a 26% increase over 1946. In all, 2386 tests were drilled, of which 1758 were wells in proved areas and 528 were wildcats. 1541 successful completions were made. Sixty-three new producing areas were discovered, the Bloomington and Cam fields being out standing. Wells drilled in productive areas opened up 151 new producing zones, the Frio-Vicksburg trend accounting for 112 such zones. At the close of the year, 15,775 oil wells in South Texas had produced 154,179,726 brl of oil, 11% more than in 1946, and gas-transmission lines had marketed 140,227,866 million cu. ft. of gas-well gas and 5,980,000 million cu. ft. of casing-head gas. 76% of the oil produced comes from fields of the Frio-Vickburg trend. E. N. T.

1352. Developments in West Virginia in 1947. R. C. Tucker. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 909–911.—892 wells were drilled in West Virginia during 1947, 127 more than in 1946. Wells completed were: gas, 644; oil, ninety-three; oil and gas, twenty-five; storage, etc, nine; dry 171. Corresponding 1946 totals were: gas, 555; oil seventy-three; oil and gas, thirty-six; storage, etc, three; dry, 148. Wells ranged from 385 to 8120 ft in depth, and the total footage drilled was 2,570,198 ft compared with 2,317,101 ft in 1946. The average well depth was 2819 ft in 1947 as compared with 2843 ft in 1946. The number of wells drilling or completions unreported at the end of the year was 310. Preliminary estimated of production for 1947 are: gas, 222,100,000 million cu. ft.; oil, 2,599,000 brl. The estimated number of producing wells are: gas 14,000; oil 17,000. E. N. T.

1353. Alberta Boom Gains Headway. C. O. Nickle. *World Oil*, May 1948, **128** (1), 267.—Imperial Oil Co. has made an important transaction in order to facilitate its operations in Canada. It now has twenty-one rigs operating in Alberta, and six are wildcats. Six seismic, two gravity-meter parties, and one magnetometer party are in action. Pipelines and refineries are planned or under construction.

At the beginning of April Leduc had fifty-one producing wells. The proved area covers 8400 acres and reserve estimates exceed 100,000,000 brl. The well-head price of the oil is $3.45.

The Pincher Creek Madison limestone discovery is 11,927 ft deep. 775 brl of 51-gravity distillate was produced in a 58-hr test, the gas–oil ratio ranging from 28,000 to 35,700 cu. ft./brl. At Bantry, in southeast Alberta, oil was found in a

Cretaceous sand at 3253–3259 ft, and the discovery well gave 125 b.d. of 24·7-gravity oil.

New oil and gas regulations have come into effect in Alberta. The salient points of these regulations are given. G. D. H.

1354. Germany Looks to Emsland for Oil. Anon. *World Oil*, Feb. 1948, **127** (10), 209.—In 1947 Germany's oil production was over a million brl below the 1946 output of 4,548,000 brl. During the War Reitbrook was greatly over-produced.

In the Emsland area the fields are anticlinal and the reserves are placed at 25,500,000 brl, with additional reserves probable. The Bentheim gas field was the first discovery, producing from the Plate Dolomite at 5200 ft.

The Hanover and Schleswig-Holstein reserves may amount to 18 million brl. Nienhagen has produced 31 million brl and Wietze 16,250,000 brl. G. D. H.

1355. Achievements and Trends in the Polish Petroleum Industry. E. Jerzyk. *Nafta*, Feb. 1948, **4**, 41.—Plans for 1947 were fulfilled or even exceeded (in natural gas and gasoline production) in spite of difficulties. Plans for 1948 include expenditure of Zl 2500 m, the drilling of 18,000 m and 130,000 tons of crude to be won. M. S.

1356. [Polish] Drilling and Production in December 1947. H. Górka. *Statystyka Naftowa Polski*, Dec. 1947, **3** [Supplement to *Nafta*, Feb. 1948, **4**], 55.—Figures are given for quantities of crude pumped, gas produced, unrefined gasoline obtained, and drilling operations in progress during December 1947. A graph is plotted showing production of crude and natural gas for 1946 and 1947 together with their origin. Some particular outstanding figures are also given. The monthly figures are: Crude—1,608,875 kg, natural gas—14,168,000 m^3, gasoline fraction—886,906 kg, drilling—3179 m in seventy-two wells. For the whole of 1947, 10,973,425 kg of crude was produced, 6,021,772 kg gasoline fraction, and 48,019 m were drilled. The article is followed by seven comprehensive tables. M. S.

Transport and Storage.

1357. Aluminium Pipeline for Sour Gas. Anon. *Petrol. Engr*, July 1948, **19** (11), 45.—Pipe sections 40 ft long, 6 in dia, wall thickness 0·28 in, were used on a 2-mile line. The pipe was welded using inert gas and electric arc. C. G. W.

1358. "Acid Pig." Adapted to Cleaning of Cement-Lined Pipe. L. S. McCaslin. *Oil Gas J.*, 8.7.48, **47** (10), 78.—Where chemical cleaning is prohibitive in cost because of large quantity of chemicals required, a combination chemical-mechanical tool is propelled through the pipe to be cleaned by acid pumped behind it. The acid is also used to knock off the scale and wash it ahead.

When necessary the tool can be backed out by applying water pressure at the outlet end of the line. G. A. C.

1359. Fundamentals of Pipeline Design. B. Miller. *Oil Gas J.*, 29.7.48, **47** (13), 223.—Some factors influencing pipeline design are discussed. Number of stations depends on the discharge pressure, length of line, and the pressure gradient. Expressions are given for estimating oil h.p. per station and total oil h.p. Maximum and minimum pressures, on which depend pipe-wall thickness, will depend on the fluid being pumped. C. G. W.

1360. Pressure Drop – 60° F. W. L. Nelson. *Oil Gas J.*, 5.8.48, **47** (14), 103.—Number 208 in the Refiners Notebook series gives a graph showing pressure drop per 100 ft equivalent length p.s.i., against gal/min at 70° F and b.d. at 60° F in Schedule 40 pipe.

Notebook No. 207 is referred to for the physical properties of the products and multiplier factors. G. A. C.

1361. Pipe Insulation at Tide Water Associated's Bayonne Refinery. W. W. Smith, *Oil Gas J.*, 22.7.48, **47** (12), 88.—The importance and advantages of efficient insulation of refinery piping exposed to weather at the Bayonne, N.J., refinery of the Tide Water Associated Oil Co. is discussed. Uninsulated flanges are shown to be a fire hazard.

Surfaces must be cleaned before insulation. For outdoor insulation a weatherproof fire-retardant jacket composed of a sheet of asphalt (bitumen)-saturated asbestos felt is cemented to an unsaturated sheet of asbestos. Valves, flanges, and fittings are also insulated, and diagrams show method for insulating pipes, valves, and flanges. Efficient maintenance is essential. G. A. C.

1362. Pipeline Program Embraces Total of 38,500 miles, U.S. and Foreign. P. Reed. *Oil Gas J.*, 29.7.48, **47** (13), 188.—Including nearly 5000 miles of new projects completed by middle of 1948, world pipeline programmes total approximately 38,500 miles.

Future projects include 20,700 miles in the U.S.A. and 4600 miles abroad.

Tables show major domestic and foreign crude oil, products, and natural-gas-line projects, giving mileage, status, bore, contractor, and location. G. A. C.

1363. Longest Post War Oil Line. F. H. Love. *Petrol. Engr*, June 1948, **19** (9), 43.—A 647-mile line from Corsicana, Texas, to Patoka, Ill., has been completed. Designed for 100,000 b.d. at 700 p.s.i., the line is laid of 20-in pipe coated with coal-tar enamel and glass fibre or asbestos felt. Prime movers at stations are three 900-h.p. motors driving centrifugal pumps. C. G. W.

1364. Plastic Pipeline Coating and Yard Processing. B. M. Laulhere, Jr. *Petrol. Engr*, June 1948, **19** (9), 104.—Previously application of plastic necessitated spraying on with solvent and subsequent baking. This led to pinhole formation unless several coats were applied. A new process whereby the plastic is fed into a stream of hot air, raised to fusion point, and then blown on to the pipe. Any thermoplastic material may be used. The coating appears to be quite satisfactory. A pipe reclamation and treating service is briefly outlined. C. G. W.

1365. Recent Development in Paints for the Petroleum Industry. G. W Oxley. *Oil Gas J.*, 8.7.48, **47** (10), 93.—Recent developments in paints, preparation of surfaces, priming, final applications, and plastic coatings are discussed.

Surfaces must be properly cleaned and dried before paints are applied. Cleaning methods include sand blasting, scraping, pickling, and where there is no safety hazard, flame cleaning or descaling may be employed.

A good general primer is red lead and oxide. Among special applications reviewed are pipeline coatings, and the need for adequate asphaltic-type coatings to combat corrosion is stressed.

For marine use, vinyl paints are good, although they cannot be used over oil-base paints.

The new plastic coatings are not superior to the well-known alkyd and phenolic products. G. A. C.

1366. Automatic Welding speeds Pipeline work. G. L. Revell and C. G. Herbruck. *Petrol. Engr*, June 1948, **19** (9), 78.—Fixtures designed to use "Lincolnweld" equipment will make circumferential welds in pipe up to 31-in dia. Hidden arc automatic deep-flux technique is used. Granular flux is deposited on the joint, bare metallic electrode is power fed into the flux blanket. Direct current produces the hidden arc. The arc heat fuses the electrode and parent metal producing the weld. The fixtures for fully automatic operation are described. C. G. W.

1367. World Tanker Fleet Now Adequate for Current Needs and Still Growing. Anon. *Oil Gas J.*, 22.7.48, **47** (12), 52.—Tables show world tank fleets by flag and T2-SE-A1 equivalents, and employment of total the U.S.A. tank-ship fleet by areas (excluding military) as at April 1, 1948.

Total world tonnage is over 23 million D.W.T. with average speed 12·9 knots. U.S. ownership totals about 42% of world's tonnage. G. A. C.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1368. Some Special Aspects of Corrosion in the Petroleum Industry and its Consequences from the Point of View of Remedies. P. Lacombe. *Bull. Ass. franç. Tech. Petrol.*, 1948 (70), 1–18.—The electrolytic mechanism of corrosion is outlined and the critical part played by traces of water in petroleum is stressed; water droplets coming out of solution in oil, consequent on a fall in temp, can be responsible for marked corrosion by pitting. Corrosion inhibitors can be of two types, cathodic and anodic, the action of which is briefly explained. Figures are given showing the inhibiting effect of small amounts of As in H_2SO_4 on the attack of metal by the acid. The concn of anodic inhibitors is much more critical than that of cathodic, and an insufficient quantity of the former can even cause more marked corrosion than its absence. The paper concludes with a discussion of alloys resistant to dry high-temp corrosion (*e.g.*, action of hot gases containing O_2 and S). Such conditions call for special steels, such as those containing Cr and Ni; diagrams indicate the oxidn changes that occur in the subsurface of such alloys. V. B.

1369. Engineering Features of Hastings Plant. J. J. Weatherby and H. N. Wade. *Refiner*, Apr. 1948, **27** (4), 81.—The most important features of the Hastings field gasoline plant of Stanolind Oil and Gas Co. are described under following headings: Design of foundation, absorption-oil circuit, fractionation of products, steam, power, and cooling-water systems, split main gas flow; arrangement of distillation and fractionation equipment and fire protection. J. T.

1370. Maintenance of Cooling Towers. J. G. De Flon. *Refiner*, May 1948, **27** (5), 145.—See Abstract No. 742 (1948).

1371. Flange Design Considerations—Flat and Dished Cover-Plates. H. E. Lonngren. *Refiner*, Feb. 1948, **27** (2), 116.—Bolted-on cover-plates of dished or flat type are all provided with a ring flange which bolts on the mating piece of the equipment. The applied load is taken up and absorbed by the flange. Two formulæ and examples are given for calculation of flange thickness for the two types of cover-plates. J. T.

1372. Flanges with Full-Faced Gaskets. H. E. Lonngren. *Refiner*, Feb. 1948, **27** (2), 117.—A method is suggested for the design of full-faced gaskets, *i.e.*, gaskets extending beyond the bolt circle. An example is given. J. T.

1373. Various Applications of Metallizing Technique in Refinery Operations. H. Batsford. *Refiner*, Feb. 1948, **27** (2), 127.—Sprayed-metal technique is being adopted as a rapid and satisfactory way of repairing corroded and worn refinery equipments such as pump rods, pistons, valve stems, and cylinder liners. Description of the spray gun and various stages in the metallizing process is given. The standard metals which are sprayed include: High-carbon, high-chrome stainless steel, 18–8 stainless steel, various carbon steels; monel and various types of bronze, also aluminium, babbits, brass, copper, iron, lead, nickel, tin, and zinc. J. T.

1374. Maintenance and Repair of Heat Exchangers. A. B. Swain. *Oil Gas J.*, 15.7.48, **47** (11), 89.—Problems encountered in the repair and maintenance of heat-exchanger equipment are numerous and varied, and include the initial dismantling.

Bolt lubricants and corrosion-resistant bolting should be used in assembly, to assist in subsequent dismantling. Tube bundles are normally removed by winches and snatch blocks; stuck tubes have to be cut. Tubes can be cleaned by water, compressed air, drilling, chemicals, and sandblasting.

Maintenance is affected by design—for example orifice-flow type of baffling is undesirable, cross-flow baffling should be employed. Baffles and tubes should be of similar metals, so should plugs for tubes. There should be a minimum of ¼-in cleaning lanes between tubes. G. A. C.

1375. Further Report on the Rivet Plate. J. A. Campbell. *Petrol. Engr*, May 1948, **19** (8), 117.—Recently due to increasing pressure drop, two 7-ft absorber columns which were equipped with rivet plates in 1938 were shut down and the plates removed. The down spouts were in bad condition, but the rivets showed no signs of wear and only twelve rivets were missing out of the total of 7000 per tray. The absorber had been handling 7,000,000 cu. ft. of gas per day.

The rivet hole is $\frac{1}{4}$ in diameter, the rivet head being $\frac{3}{4}$ in diameter. The head is conical underneath and provided with four ribs to prevent it from seating. Rivet spacing is 1 in. each way. Advantages claimed for the rivet plate include no channelling, the gassing at one rivet starting surrounding rivets gassing; a pressure drop of 1 p.s.i. if the column runs dry; less entrainment, and steadier operation. The slots are small enough to retain the trays full of oil with no gas going through the column.

G. K. A.

1376. Protection and Maintenance of Petroleum Property. C. R. E. Merkle. *Refiner*, May 1948, **27** (5), 134.—In protecting petroleum-refinery plants against moisture, acids, alkalis, solvents, and oils the following requirements in the application of the protective coating should be carefully followed: (1) preparation of surface; (2) application of coatings under proper conditions; (3) adequate film thickness; and (4) selection of coating material. In isomerization plants and also in areas near cooling towers, two coats of primer and one of finishing material should be applied in as short an interval as possible. Film thicknesses of at least 3 mils and better still 4–5 mils are necessary for protection against moisture and gases. Phenolic coatings give good protection against moisture and acid fumes and those with chlorinated-rubber base are recommended against alkaline materials. Vinyl resins are inert to moisture, acids, and alkalis, but require very careful surface preparation preferably by sand blasting, and are more difficult to apply. For stacks and hot surfaces silicone aluminium heat-resistant finishes are now available. Zinc-dust galvanizing metal primers have been used extensively on galvanized metal buildings and alkyd finishes on transport equipments.

J. T.

1377. Straight Line Chart Determination of Absorber Extraction Efficiency. E. G. Ragatz. *Petrol. World*, Mar. 1948, **45** (3), 19; *Refiner*, Feb. 1948, **27** (2), 83.—See Abstract No. 431 (1948).

1378. Gasoline Plant Process Water Treatment. J. C. Hutcheson. *Petrol. Engr*, July 1948, **19** (10), 184.—It is necessary to make periodic checks on process water to see that treatment efficiency is being maintained and personnel are fully acquainted with treatment problems. The writer describes a visit to a series of plants. In general, water treatment in these plants consisted of lime and soda ash batch treatment, Zeolite treatment, or no treatment at all as far as raw water is concerned. Two plants with lime and soda initial treatment use an aftertreatment of phosphate and tannin in boiler and cooling water, one has continuous blowdown on the cooling water and one on the boiler water. The Zeolite-using plants use phosphate and tannin treatment for boiler water, one uses acid treatment of cooling water and one Scale X as treatment. All use algaecide, generally copper sulphate with another algaecide when copper sulphate becomes ineffective. The conditions met with at the plants are described with details of the further procedure suggested. G. K. A.

Distillation.

1379. Fractionation of Naphthas. H. Litwin. *World Petrol.*, Aug. 1948, **19** (8), 80–83.—A new plant for the fractionating of naphthas is described featuring the Koch Kaskade fractionating tray. A crude tower produces an overhead (450° F F.B.P.) which is fed to a Perco regenerative desulphurization unit also designed for high-temp cat reforming. Vapours from the cat chamber go to a 4-ft dia, twenty-tray fractionator for stabilizing after desulphurization. Sulphur reduction is 80–90% and O.N. is raised 12–16 points over untreated gasoline (both containing 3 ml T.E.L.). In the naphtha fractionation each simultaneous cut has a separate tower of 3-ft dia and twenty trays. Long-range naphtha is fed into the middle of tower No 2. The bottoms go to a thermo-siphon reboiler and are fed into tower 3 and so on to towers

4, 5, and 6. The Kaskade tray is compared with the conventional bubble-cap tray, and its action shown by diagrams. Pressure gradient through the former is less than half that through the latter yet vapour–liquid contact is improved. E. B.

1380. Hydrocarbon Absorption and Fractionation Process Design Methods. Pt 13. Plate-to-Plate Multicomponent Fractionation Calculation Methods. W. C. Edmister. *Petrol. Engr*, June 1948, **19** (9), 47.—Three methods of making plate-to-plate component distribution calculations for multicomponent fractionation are considered, namely the methods of Lewis–Matheson, Thiele–Geddes, and Hummel. These methods have the following features in common: (*a*) assumptions both primary and secondary must be made, checked, and revised; (*b*) component distribution calculations are made for each plate, starting at the top and the bottom and working towards the feed plate; (*c*) the theoretical equilibrium plate concept is employed; (*d*) component material balances plus vapour–liquid equilibrium form the method of going from plate to plate; (*e*) heat balances are used to determine variations in the L/v ratio throughout the column.

The assumptions are: (1) in the Lewis–Matheson method the distillate and bottoms product and the reflux ratio; (2) in the Thiele–Geddes method, primarily the number of equilibrium plates and the reflux ratio and secondly the temperatures of the theoretical plates; (3) in the Hummel method, the number of equilibrium plates, the reflux ratio, and the temperature gradient in the column.

The three methods are illustrated by detailed solutions of the same problem, a six-component mixture. G. K. A.

1381. Multicomponent Distillation Calculations. E. G. Scheibel. *Refiner*, Apr. 1948, **27** (4), 92.—Factors involved in the design of column for multicomponent distillation are discussed in detail. Methods for the calculation of minimum reflux ratio, the approximate number of trays required for a reflux ratio greater than the minimum, and the exact number of theoretical trays are described. A method of determining the ratio of the key components on the optimum feed tray is given, and the equations of Underwood in a simple form have been applied to calculate the number of trays required to obtain this ratio of the keys. A new method for adapting the Ponchon method to multicomponent distillation is described which simplifies the design of multicomponent distillation column including heat balances on all trays. J. T.

1382. Practical Considerations in Process Design of Fractionators. L. Bray. *Refiner*, Apr. 1948, **27** (4), 115.—Salient features in the design of large-scale fractionators are pointed out and discussed. These include material of construction, operating pressures and temperatures, number of trays, tray spacing, column diameter and height, downcomer area, weirs, bubble caps, chimneys, tray construction, column openings, feed entries, overhead vapour, product draw off, reflux, relief valves, manholes, internal heating elements, liquid level control, gauge glasses and sample, pressure and temperature connections. J. T.

1383. Economic Distillation Design. W. D. Harbert. *Refiner*, Apr. 1948, **27** (4), 106.—A general method for determination of economic optimum operating conditions applicable to plants already in existence (*Industr. Engng Chem.*, 1947, **39**, 940) has been applied to the design of a distillation system. J. T.

1384. Simplified Multi-Component Fractionation Calculations. Part II. Multi-Component Tray Calculations. R. V. Bailey and J. Coates. *Refiner*, Feb. 1948, **27** (2), 113.—A modification of Scheibel's method of tray calculation for a multi-component system is given. It is shown that the method has a greater accuracy and has the advantage of giving directly the optimum feed tray. J. T.

1385. Preplanning Turnarounds. Use of Alloys Shortens Downtime. A. L. Foster. *Oil Gas J.*, 1.7.48, **47** (9), 72.—Important principles to be followed for efficient maintenance and repair of distillation equipment are outlined, and use of alloys in high-temperature distillation operations discussed, based on experience at the Linden, N.J., refinery of Esso Standard Oil Co.

The main principle is carefully preplanning the complete turnaround; studying records of previous operations, and listing jobs to be done.

This refinery has standardized on two main types of alloy tubes and piping in distillation service to combat the two different types of corrosion, one occurring in hot and the other in cooler sections of the equipment.

For conditioning units for inspection, various innovations have been employed, such as feeding a light, low-boiling oil stock to a distillation unit which has been operating on a heavy stock, thus simplifying emptying and cleaning of tower and lines. G. A. C.

Absorption and Adsorption.

1386. Ohio Oil Co.'s Midget L.P.G. Plant Produces 350 Brl per Day. R. B. Tuttle. *Oil Gas J.*, 1.7.48, **47** (9), 74.—The L.P.G. plant at the Robinson, Ill., refinery of the Ohio Oil Co. has produced 350 b.d. of 225-p.s.i. vapour pressure product on a staff-designed unit built for a production rate of 250 b.d.

The flow arrangement is conventional; only two pumps are used, and fintube-type units are employed for cooling, condensing, and heating. The column is constructed of 24-in pipe.

Operating pressure on the depropanizer is 300 p.s.i. and on the L.P.G. column 400 p.s.i. A flow sheet illustrates the article. G. A. C.

1387. Modern Process Methods to Improve L.P.G. Recovery. G. W. McCullough, K. H. Hachmuth, and A. J. Miller. *Refiner*, Apr. 1948, **27** (4), 87.—See Abstract No. 750 (1948).

Solvent Extraction and Dewaxing.

1388. Production of Aromatic Hydrocarbons for Aviation Fuels by Solvent Extraction. S. A. E. Moy. *Industr. Chem.*, 1948, **24**, 433–440, 505–508.—A process is described for the production of a 95% (wt) aromatic concentrate from light naphtha by extraction with liquid SO_2 at $-20°$ F. Solvent flowing down a 67-ft packed column countercurrently to light naphtha produces a primary extract (75% aromatics). The primary extract in liquid SO_2 is washed with kerosine in a 100-ft tower. The secondary extract so produced contains non-aromatic hydrocarbons from the kerosine in place of some of the original naphthenes and paraffins. After solvent evaporation, dist of the extract produces the required aromatic concentrate overhead. Sulphuric-acid treatment and re-running are required. Data are given on aromatic hydrocarbon analyses of the feed, raffinates, and extracts, engine performance of refined extract, and plant operating conditions. Recovery of the C_7–C_8 aromatic hydrocarbons is 93% of the total present in the feed stock. A theoretical treatment of the process is given, and physical constants and engine performance of pure hydrocarbons present in the light naphtha are tabulated. E. B.

Cracking.

1389. Casper Plant Called Model of Small Refinery Planning. Anon. *Refiner*, May 1948, **27** (5), 121.—The latest unit added to the Casper, Wyoming, Refinery of the Texas Co. is a fluid catalytic-cracking unit, which is described in detail. Certain improved features are discussed. Vessels are arranged in such a way as to reduce excessive elevation of the unit and the complexity of piping. The unit is the first to utilize the "balanced-pressure" technique where the reactor and the regenerator are operating side by side and at the same level, the catalyst circulation being brought about by pressure differentials. The unit consists mainly of preheat furnace, reactor, fractionator with a slurry settler built into its base, regenerator, cyclone separators, and electrical precipitators. The catalyst used is Kellogg Polyco. J. T.

1390. Applications of the Fluid Catalyst Technique to Catalytic Cracking and Hydrocarbon Synthesis. R. W. Krebs. *Refiner*, May 1948, **27** (5), 115.—A general review of developments in the field of fluid catalytic cracking especially in connexion with the synthesis of hydrocarbons and chemicals is given. J T.

1391. N.C.R.A. Catalytic Desulfurization Reforming Unit Operates on Variety of Charging Stocks. R. B. Tuttle. *Oil Gas J.*, 15.7.48, **47** (11), 86.—Data are given for the operation of the Perco catalytic desulphurization-catalytic reforming unit in the McPherson, Kansas, refinery of the National Co-operative Refinery Association on various stocks, including straight-run and cracked gasoline, straight-run and cracked naphtha, both alone and in combination.

The refinery has a crude-oil capacity of 20,000 b.d., the throughput of the Perco unit being 500 b.d.

The basic flow plan of the Perco unit is similar to that given in the process section of *Oil Gas J.*, 1.4.48, **46** (48), 117, except that changes include a heat exchanger in the fractionater overhead and a reboiler in the stabilizer column.

Processing periods varied from 36 hr to several days, depending on type of change stock and operation temperature—and regeneration periods were about 18 hr.

Operating pressure on the reactors ranges from 30 to 150 p.s.i.g., but olefin formation is more favourable with the lower pressures. G. A. C.

1392. Processing Pennsylvania Crude. D. Read. *Petrol. Engr*, June 1948, **19** (9), 122.—The article studies data available on the processing of Pennsylvanian crude with particular reference to methods to increase the yield and octane rating of the gasoline and the yields of distillate fuels produced. The processes considered are U.O.P. thermal reforming, U.O.P. thermal cracking, and fluid catalytic cracking. The results show that catalytic cracking increases the yield of gasoline and the octane rating of the gasoline in comparison with thermal cracking. G. K. A.

1393. Examination of Tar from the Pyrolysis of Kerosine. N. M. Karavaev and I. M. Vener. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1948, 637–641.—Condenser tar from the pyrolysis of kerosine was fractionated into four cuts, below 170° C, 170–200° C, 200–230° C, and 230–240° C. Hydrocarbon-group analyses of the last three fractions were made, and they were examined for their content of indene, naphthalene, and methyl-naphthalene respectively. Further re-distillation and analysis showed indene (1·4%) to be present in the 175–182° C cut, naphthalene (2·8%) in the 200–230° C cut, and methyl-naphthalenes (1·8%) in the 226–250° C cut. The yields are calc on the original condenser tar; the methyl-naphthalenes consisted of equal parts of the α- and β-isomers. A sample of sludge from kerosine pyrolysis yielded 3·2% of mixed methyl-naphthalenes. V. B.

1394. Notes on the Initial Operation and Test Run of 100-octane Aviation Gasoline Plant. U. Tsao. *Petrol. Engr*, July 1948, **19** (10), 161.—Details are given of the processes, initial operation, and test run of a 100-octane aviation-gasoline plant in Houston, Texas.

This plant consists of two thermofor catalytic-cracking units, one U.O.P. hydrofluoric-acid alkylation unit, and one U.O.P. butane-isomerisation unit. Details of the various processes are given together with the methods of bringing the units on stream and the various difficulties met with. Flow sheets of the various units are given. G. K. A.

1395. Gas Turbine Plant for 1500° F Operation. H. A. Altorfer. *Petrol. Engr*, June 1948, **19** (9), 161.—Extensive industrial application of the gas turbine has been limited in the refinery to driving air compressors for catalytic cracking. These turbines operate at temperatures less than 1000° F. For more extensive operation higher operating temperatures are required, and the article describes an experimental turbine working at 1500° F. This consists of two turbines, one driving the air compressor and the other driving a dynamometer, an axial flow compressor, a heat exchanger, two combustion chambers, and a dynamometer. The method of insulation of the various parts is described, the insulators being magnesia and diatomaceous silica. G. K. A.

Hydrogenation.

1396. Product Distribution in the Synthesis of Hydrocarbons from Carbon Monoxide and Hydrogen. C. W. Montgomery and E. B. Weinberger. *J. Chem. Phys.*, 1948, **16**, 424.—The Fischer–Tropsch synthesis with cobalt catalysts at atmospheric pressure

and 190–200° C has been found to give a relatively small quantity of C_1, C_2, and C_4 hydrocarbons. One suggested explanation is that this product distribution is the result of some "polymerization–depolymerization equilibrium in the last stages of the process." This letter points out that thermodynamic equilibrium among the *n*-paraffins yields a distribution which is qualitatively similar to that observed experimentally. A. R. W. B.

Chemical and Physical Refining.

1397. Hypersorption. A. L. Foster. *Oil Gas J.*, 12.8.48, **47** (15), 90.—The Hypersorption unit of the Midland, Mich., plant of Dow Chemical Co. is described.

The process employs the principle of selective adsorption of hydrocarbons by a moving bed of activated carbon particles, with the subsequent removal of the adsorbed hydrocarbons by heat and steam. It was developed by the Union Co. of Calif.

Tables show material balances for operations on two raw-gas charges (concentration and separation of ethylene), and figures include typical records of control performance of the Hydrosorber under widely varying conditions and drawings showing control of carbon flow. G. A. C.

Special Processes.

1398. Synthetic Alcohol from Petroleum. R. S. Aries. *Refiner*, Apr. 1948, **27** (4), 124.—See Abstract No. 766 (1948).

Metering and Control.

1399. Basic Design and Field Performance of the Control and Measurement Instrumentation of an Alkylation Unit. H. F. Moore and G. W. Gross. *Inst. Practice*, 1948, **2**, 400–407.—Describes the automatic control instrumentation of an alkylation unit built at Aruba just prior to the war when the alkylation process was a relatively new development, introducing new problems of control technique. The original basis of the instrumentation choice is given, with the modifications which resulted from the first 18 months' operating experience. Practical problems involved in the close control of the fractionating column temp for the separation of pure components are discussed, as are also limitations of the conventional ball-float level controller and column-pressure control by butterfly valve in the overhead vapour stream. Particular problems are illustrated by actual plant-chart records. The approach is practical rather than mathematical. R. T. D.

1400. Instrument Maintenance. H. A. Hulsberg. *Petrol. Engr*, July 1948, **19** (10), 178.—The personnel required and their qualifications are discussed, together with the organization required for efficient servicing and maintenance of plant instruments. Suggested equipment for the maintenance workshop is given. This of course depends on the type of instruments to be repaired. It is suggested that each maintenance man has a grounding in all instruments and specializes on a few. Apart from a workshop, the instrument maintenance man should keep records of all instruments and also a library of handbooks for each instrument and various instrument periodicals. G. K. A.

1401. Basic Principles in Process Control. J. B. Arant. *Refiner*, Feb. 1948, **27** (2), 96.—Some essential factors to bear in mind in the installation of process-control instruments are: requirements of the process; problems involved, accuracy of the control, available space, operation variables, safety requirements, installation, and provision of means to increase the controllability. J. T.

Safety Precautions.

1402. Extinction of Petrol Fires by Methyl Iodide. A. Nicholson. *Nature*, 1948, **162**, 111.—The apparent superiority of methyl iodide over carbon tetrachloride is attributed to the higher volatility of the former; but other factors must be taken into account. Measurements of the concentrations required to extinguish a standard heptane flame show that the effectiveness of allied compounds lies in the order methyl bromide > methyl iodide > carbon tetrachloride, but the latter is not markedly

inferior. The practical difficulties of containing methyl iodide within the pump-type extinguisher are almost insuperable. Methyl iodide and carbon tetrachloride appear to have approximately the same toxicity, and it is concluded that there are no grounds for replacing carbon tetrachloride by methyl iodide. H. C. E.

1403. Occupational Skin Lesions Due to Pitch and Tar. P. Ross. *Brit. Med. J.*, 1948, ii, 369–374.—An account of the lesions produced by tars and pitches derived from coal and wood. Clinical effects are described in some detail, with coloured illustrations. Among prophylactic measures barrier creams occupy a high place; a formula for a starch–kaolin paste for the prevention of tar erythema is given. An analysis of the lesions occurring among 170 workers over a 12-year period is included. V. B.

PRODUCTS.

Chemistry and Physics.

1404. Effect of Variations in Surface on the Photolysis of Acetone. E. W. R. Steacie and B. DeB. Darwent. *J. Chem. Phys.*, 1948, **16**, 230–232.—Acetone photolysis in the "continuum" and "banded" regions has been studied in clean quartz vessels and in vessels coated with potassium chloride and with lead. No appreciable change in the C_2H_6–CO ratio occurs in the coated vessels. Since biacetyl formation is partly heterogeneous the ratio would be expected to be sensitive to the condition of the surface. A. R. W. B.

1405. Nature and Properties of Asphaltenes. M. Bestougeff. *Chim. et Ind.*, 1948, **60**, 137–141.—Nellensteyn's theory of asphalt constitution is reviewed, and the considerable amount of evidence against it discussed. The principal chem and physical characteristics of four types of asphaltenes and of a petroleum resin are tabulated; it is considered that one of the main properties of an asphaltene is the C–H ratio. The rules regulating the solubility of the higher hydrocarbons in the lower paraffins are discussed, and it is shown that, in this respect, certain synthetic lubricating fractions are very similar to asphaltenes. The author considers that asphaltenes are bodies, whose very varying composition and properties show a gradual change largely following their C–H ratio; moreover, by hydrogenation or dehydrogenation they can be converted into resins and carbenes respectively. It is concluded that asphaltenes consist of heterocyclic compounds of different series and that the existence in asphaltenes of micro-crystalline graphite (Nellensteyn's theory) is not proven. V. B.

1406. Poisoning of Platinum Catalysts at High Temperatures. R. H. Savage. *J. Chem. Phys.*, 1948, **16**, 237–240.—Poisoning films of exceptional thermal stability are formed on a platinum catalyst when heated in a silicone vapour at pressures of the order 10^{-3} mm. These films prevent the combination of hydrogen and oxygen at low pressures and are not removed until heated to about 1440° K in the presence of hydrogen. It is suggested that the film may consist of a silicon oxide oriented with the silicon atoms attached directly to the platinum and presenting an outer layer of oxygen atoms, effectively shielding the catalyst. A. R. W. B.

1407. Catalysts in Petroleum Refining. F. Heinemann. *Refiner*, May 1948, **27** (5), 138.—Catalysts used in petroleum refining are reviewed in some detail. Over 40 references are given. J. T.

1408. Effect of Steam on some Alumina Transitions. P. W. Cooke and J. N. Hargreaves. *Trans. Faraday Soc.*, 1947, **43**, 395–398.—Evidence has been found that steam catalyses both the transformation of γ-alumina and Boehmite to α-alumina and crystal growth in γ-alumina. Rates of transformation increase with steam pressure at fixed temp. Increase of pressure in the absence of steam does not lower the transition temp and alumina of low fluoride content (Gibbsite) undergoes transformation as readily as less pure forms. E. B.

1409. Dielectric Measurements of Liquids at Microwave Frequencies. G. E. Crouch. *J. Chem. Phys.*, 1948, **16**, 364–371.—A method of measuring the dielectric properties of medium and high-loss liquids at microwave frequencies is described. The liquid sample is placed in an open circuit-terminated section of wave guide, and standing wave-ratios are measured at intervals as the length of the dielectric column is changed. A simple procedure for calculating the dielectric properties from these measurements is presented. Some dielectric properties of liquids measured by this method at 3-cm wavelength are given. A. R. W. B.

1410. Simplified Method for Computing the Equilibrium Composition of Gaseous Systems. F. J. Krigger and W. B. White. *J. Chem. Phys.*, 1948, **16**, 358.—A simplified procedure is described for computing the equilibrium composition of a gaseous system of any degree of complexity either manually or by means of punched cards. The method presents a system of n equations in n unknowns so that each of the major components is given as a linear expression of the minor components only, while the logarithm of the minor components is given as a linear expression in terms of the free-energy change for the dissociation reaction which defines the minor components, the logarithm of the major components, and the total pressure. An iteration process then gives an exact solution. One type of reaction to which this method may be applied is the combustion of fuels in air. A. R. W. B.

1411. Simple Expressions for the Heat Capacities of Gases. B. L. Crawford and R. G. Parr. *J. Chem. Phys.*, 1948, **16**, 233–236.—A table of constants is given whereby the best approximation of the form $C_p^\circ = A_0 + A_1T + A_2T^2$ to the heat capacity of a gas with translational, rotational and vibrational (harmonic) degrees of freedom may be written down knowing the vibrational frequencies. A. R. W. B.

1412. An Introduction to the Study of Gas Flows at Very High Temperatures. N. Manson. *Rev. Inst. Franç. Pétrole*, 1947, **2**, 539–552, 594–607; 1948, **3**, 3–12, 42–49, 55–61.—After a survey of fundamental principles, equilibrium reactions are examined. The thermodynamic calculation of equilibrium const and the calculation of the proportions of the various constituents in a dissociated gaseous mixture is discussed. A section is devoted to the construction of thermodynamic diagrams, including calculation of enthalpy and entropy. The fourth and fifth instalments deal with the determination of the condition of a burnt gas immediately following a reaction and include a brief consideration of detonations and explosive waves. V. B.

1413. Thermodynamics of the System Benzene–Biphenyl. H. Tompa. *J. Chem. Phys.*, 1948, **16**, 292–302.—The vapour pressure of benzene and the heat of dilution of benzene–biphenyl mixtures have been measured at 25° C. Experimental details are fully described. The results are shown to be in fair agreement with Guggenheim's formulæ based on the lattice model. Experimental results of other authors are examined and shown to be in agreement. A. R. W. B.

1414. Mercury Photosensitised Reactions of Ethane. D. DeB. Darwent and E. W. R. Steacie. *J. Chem. Phys.*, 1948, **16**, 381–386.—The effect of pressure on the initial stages of the reaction has been studied showing that the production of methane increases with decreasing ethane pressure and is inhibited by the presence of molybdenum oxide at room temperature. It has been shown that hydrogen atoms are produced in the initial stages of the reaction, and it is concluded that the initial step is the splitting of the C–H bond and not the formation of an active ethane molecule. A. R. W. B.

1415. Reaction of Hydrogen Atoms with Some Oxygen Containing Organic Compounds. W. R. Trost, R. DeB. Darwent, and E. W. R. Steacie. *J. Chem. Phys.*, 1948, **16**, 353–357.—The reaction of atomic hydrogen, as produced by a discharge, with methyl ether, acetaldehyde, and ethylene oxide has been studied; methods of analysis for the products are outlined. The mechanisms of the reactions are discussed in detail, and it is concluded that the primary reactions involve the removal of a hydrogen atom from the molecule under attack to form hydrogen molecules, the secondary reactions

involving the cracking of the remainder of the organic molecule. The main products of the reaction are :

from methyl ether, CH_4, CO, H_2O, C_2H_4, and HCHO ;
from acetaldehyde, CH_4, CO, and C_2H_4 ;
from ethylene oxide, CH_4, CO, and CH_3CHO.

A. R. W. B.

1416. Reaction of Hydrogen Atoms with the Paraffin Hydrocarbons. W. R. Trost and E. W. R. Steacie. *J. Chem. Phys.*, 1948, **16**, 361–364.—The reactions of atomic hydrogen, as produced by a discharge, with ethane, propane, and neopentane have been studied. It was found that each reaction proceeds at approximately the same rate with activation energies of *ca*, 9 k. cals assuming a steric factor of 0·1. The suggestion is put forward, however, that the energies are somewhat lower than this with correspondingly smaller steric factors. Principal products : ethane gave methane and with propane methane was main product with a small amount of ethane in addition. With neopentane substantial amounts of ethane were formed and this was thought to be done in one step from an excited neopentane molecule. A. R. W. B.

1417. Ultrasonic Velocity in a Series of 1-Olefins. R. T. Lagemann, D. R. McMillan, and M. Woolsey. *J. Chem. Phys.*, 1948, **16**, 247–249.—Ultrasonic velocities over the temperature range 10–30° C have been determined for seven members of the 1-olefin series. The ultrasonic velocity is found to vary linearly with temperature. Densities and refracture indices were also measured, and values of the molecular sound velocity, adiabatic compressibility, and molecular refractivity computed. The molecular constant $\frac{M.V^{\frac{1}{3}}}{d}$ is found to be substantially constant with temperature and to be strictly additive for the series members studied. A. R. W. B.

1418. Average Length and Radius of Normal Paraffin Hydrocarbon Molecules. W. J. Taylor. *J. Chem. Phys.*, 1948, **16**, 257–267.—Previously published formulæ for the average length and radius of long-chain molecules are applied to a model of the normal paraffin hydrocarbons—a model with fixed bond lengths, the valence angles between such links being fixed, allowing an internal rotation, but this is restricted by a potential function or reduced to a torsional motion. Calculations are presented for a range of values of the parameters, and from thermodynamic and spectroscopic data the most probable values are predicted and discussed. The predicted ratios of the values of the average length and radius to the values calculated for free rotation are : 1·76, 1·48, 1·36, 1·29 at 0°, 100°, 200°, 300° C respectively. The effect of steric hindrance is discussed, and it is suggested that the calculated values are probably appreciably low because of the effect of steric hindrance. A. R. W. B.

1419. Ionization and Dissociation of Paraffin Hydrocarbons by Electron Bombardment. M. B. Koffel and R. A. Lad. *J. Chem. Phys.*, 1948, **16**, 420–422.—Mass spectrometer analyses give appearance-potential values for fragments resulting from electron bombardment of the paraffin hydrocarbons up to hexanes plus *n*-heptane and 2 : 2 : 3-trimethyl butane. The values for methane, ethane, propane, and butanes are compared with previously published data. A. R. W. B.

1420. A "Metallic" Model for the Spectra of Conjugated Polyenes. N. S. Bayliss. *J. Chem. Phys.*, 1948, **16**, 287–292.—Evidence is growing to suggest that the unsaturation electrons in organic molecules containing systems of conjugated double bonds have many of the characteristics of the "free" electrons in metals or semiconductors. With this assumption it is predicted that the oscillator strength of the main adsorption band of a *trans*-conjugated polyene is given by $F = 0{\cdot}134\ (2N + 1)$ where N is the number of double bonds. The wave number of the main bond is related to the length of the conjugated system and the number of double bonds with moderately good agreement with experimental evidence. A. R. W. B.

1421. A Rapid Calculation of the Specific Dispersion of Saturated Hydrocarbons. S. G. Hindin. *Petrol. Engr*, May 1948, **19** (8), 290.—See Abstract No. 774 (1948).

1422. Films at Oil–Water Interfaces. E. Hutchinson. *J. Coll. Sci.*, 1948, **3**, 219–250.—Part I. In measuring the interfacial tension of an oil–water interface, the ring, drop-volume, pendant-drop, and sessile-bubble methods were all tried. The latter proved the most convenient and reliable, and detailed instructions for obtaining the best results are described. Interfacial tensions at 23° C and surface pressures between water and benzene solutions of C_n acids and alcohols, where n = 2–6 for acids and 3–6 for alcohols, are given. Except when the materials were not quite pure, the interfacial tension did not change with the age of the film, after the first few minutes. A mathematical discussion deduces the relation between surface pressure and area occupied per molecule, and it is shown that transition points are obtained. It is concluded that the alcohols are more condensed in the surface film than are the corresponding acids.

Part II. Since the drop-volume method is more easily thermostatted than the sessile-bubble method, the former was used in the following experiments, as it had been shown in Part I that with pure materials no ageing occurred. Data are given for the C_9 acid and alcohol dissolved in benzene, *cyclo*hexane, nitrobenzene, and tetradecane, and for myristic acid in benzene and *cyclo*hexane, at temperatures between 10 and 40° C. The results show that an interfacial film is formed in which the polar group is anchored at the interface and the hydrocarbon chain is entirely in the oil phase. Following a discussion on the significance of the area *versus* surface-pressure curves, it is concluded that the cohesion between solvent molecules and the hydrocarbon chains is an important factor, and the lateral adhesion in films adsorbed at oil–water interfaces may be greater than those at air–water interfaces. H. C. E.

1423. Some Aspects of the Industrial Oxidation of Lower Aliphatic Hydrocarbons. J. E. Bludworth. *Refiner*, Apr. 1948, **27** (4), 110.—Direct oxidation of gaseous hydrocarbons, reaction mechanism, and the effect of temperature on yield are discussed in general terms. J. T.

1424. Processes in the Oxidation of Hydrocarbon Fuels. I. A. D. Walsh. *Trans. Faraday Soc.*, 1946, **42**, 269–283.—Oxidn of a hydrocarbon is a chain reaction involving free radicals as carriers. The " point of oxygen attack " is taken to mean the point at which the free radicals attack the mol. Much evidence indicates that the order, 3°>2°>1°, is that of the reactivity of CH bonds towards electrophilic reagents, and it has been shown that the CH bond strength decreases in the order 1°>2°>3°. Rice, working on the thermal decomposition of hydrocarbons, found the relative probabilities of attack of alkyl radicals at 1°, 2°, and 3° carbon atoms were 1 : 3 : 33 at 300° C. Alkyl hydroperoxides are the first molecular products found in low-temp hydrocarbon combustion. Max concn of peroxides may be 1 in 10^5. The reactions

$$\mathrm{RH} \longrightarrow \mathrm{R} + \mathrm{H}$$
$$\mathrm{R} + \mathrm{O_2} \longrightarrow \mathrm{ROO}$$
$$\mathrm{ROO} + \mathrm{RH} \longrightarrow \mathrm{ROOH} + \mathrm{R}$$

are suggested as a likely chain for peroxide formation. The decomposition of 3°, 2°, and 1° alkyl hydroperoxides is discussed, the general tendency being fission at the O–O bond followed by that of an adjacent C–C bond. The Pope, Dykstra, and Edgar, and the Lewis and Von Elbe theories for degradation of fuels are considered, and it is concluded that they are unsatisfactory. Degradation schemes for *iso*octane and *neo*hexane are formulated showing hydroperoxide formation and chain-propagation mechanism. E. B.

1425. Processes in the Oxidation of Hydrocarbon Fuels. II. A. D. Walsh. *Trans. Faraday Soc.*, 1947, **43**, 297–305.—The formation of CO and excited HCHO in low-temp combustion are considered. Degradations such as are described in the previous abstracts are complicated by the decomposition of alkyl and peroxide radicals, the former to olefins. Decomposition of the peroxide radicals offers an explanation of the formation of CO during oxidn. The appearance of a neg coeff of oxidn rate in the range 400–450° C may be simply explained on the basis of peroxide radical decomposition (a non-branching process) becoming more important in this range than at lower temp where peroxide mol decomposition (branching process) is predominant. Thermal explosion may occur at higher temp because of greatly increased radical

decomposition. Decomposition of ROOH but not ROO is thought to be catalysed by aldehydes; thus explaining the apparent greater stability of ROO. Low-temp hydrocarbon combustion is associated with the appearance of cool flames. The spectra of cool flames are identical with the spectrum of HCHO. The chemiluminescence cannot be due to the reaction of CH_3– with O_2 producing HCHO, as the energy liberated is insufficient to raise the HCHO to the excited state. Other reactions are considered, but the same objection generally holds. Quantity of light emission suggests that the reaction leading to the formation of excited HCHO is of rare occurrence and not part of the main chain; it is tentatively concluded that the reaction is a radical combination.

E. B.

1426. Processes in the Oxidation of Hydrocarbon Fuels. III. A. D. Walsh. *Trans. Faraday Soc.*, 1947, **43**, 305–313.—A survey is given of the two-stage nature of "low temp" combustion. The process is characterized by two ignition lags, t_1 and t_2. During t_1, peroxides followed by formaldehyde become detectable, culminating in the cool flame when a critical concn of hydroperoxide is reached. Products formed in the cool flame initiate t_2 chains which may proceed to a chain thermal explosion. The t_2 chains are supposed to be similar to those occurring in high-temp oxidn of paraffins (see part II), but with the addition of degenerate branching via aldehydes, particularly HCHO. The periodicity of cool flames is dealt with and a paper by Frank–Kamenetzki is described fairly fully. The scheme proposed by Frank–Kamenetzki to explain the kinetic facts accords well with the author's oxidn theory.

E. B.

1427. Molecular Interaction and Infra-Red Absorption Spectra. M. Davies. *J. Chem. Phys.*, 1948, **16**, 267–279.—The absorption spectra of methyl alcohol between 3μ and 15μ at varying concentrations in solution have been studied. Clear indications have been obtained of at least two new bands outside the 3-μ region which arise from the associated molecules. Similarly the absorption spectra of phenol in solution between 6·5μ and 15μ have been studied. Prominent features which appear only in more concentrated solution are ascribed to vibration in associated molecules. These results are compared with those for methyl alcohol.

A. R. W. B.

1428. An X-Ray Study of the Stepwise Melting of Anhydrous Sodium Palmitate. H. Nordsieck, F. B. Rosevear, and R. H. Ferguson. *J. Chem. Phys.*, 1948, **16**, 175–180.—An X-ray study of the progressive melting of anhydrous sodium palmitate shows that as the soap is heated it transforms from the fully crystalline state (below 117° C) to the isotropic liquid state (above 295° C) by way of two intermediate basic structures. Both of these structures are liquid crystalline, *i.e.*, crystalline in the direction of the long spacing and liquid-like laterally.

A. R. W. B.

1429. Electric Dipole Moment of Some Styrenes. K. B. Everard and L. E. Sutton. *Nature*, 1948, **162**, 104.—The dipole moments of four nuclear methylated styrenes have been measured in benzene solution at 25° C. The numerical values show anomalies, the cause of which is discussed.

H. C. E.

1430. Hydrocarbon Sulphonylation. W. H. Lockwood. *Chem. Ind.*, May 1948, **62** (5), 760.—The Reed reaction, involving the sulphonylation of saturated aliphatic hydrocarbons by reaction with sulphur dioxide and chlorine under influence of actinic light, yields sulphonyl chlorides.

These materials were developed concurrently in America and Germany and found many applications such as detergents, tanning agents, and wetting agents. Their amides and amido-esters are also important in tanning, in anti-foaming agents, and in the preparation of textile processing oils and cutting oils.

A very comprehensive bibliography is included.

O. M.

1431. Application of Thermodynamics to Hydrocarbon Processing. Part VIII. Vapour Pressures and Equations of State. W. C. Edmister. *Refiner*, Feb. 1948, 27 (2), 100.—A number of existing vapour-pressure charts and equations of state are reviewed and discussed.

J. T.

1432. Applications of Thermodynamics to Hydrocarbon Processing. Part X. Pseudo-Critical for Mixtures. W. C. Edmister. *Refiner*, Apr. 1948, **27** (4), 134.—The pseudo-critical phenomenon in a hydrocarbon mixture is described, and its calculation from the critical properties of the components by empirical equations or from gravity and boiling point of the mixture by graphical methods is given. The pseudo-critical concept is used in calculation of vapour density of a hydrocarbon mixture, the estimation of isothermal pressure corrections to entropy and enthalpy in multicomponent systems, and the evaluation of fugacity of a multicomponent vapour. J. T.

1433. Application of Thermodynamics to Hydrocarbon Processing. Part XI. Derivations for Graphical P.V.T. correlations. W. C. Edmister. *Refiner*, May 1948, **27** (5), 93.—Equations are derived for the specific heat, Joule–Thomson coefficient, entropy, energy, and enthalpy in terms of the compressibility factor $Z = PV/RT$ and the volume residual $a = RT/P - V$. An equation for the activity coefficient, *i.e.*, the ratio of fugacity to pressure, is also developed in terms of a. The calculations of the derivatives and the integration of functions are illustrated by equations and charts. J. T.

1434. Theory of Rate Processes and the Viscosity of Long-Chain Compounds. W. C. Wake. *Trans. Faraday Soc.*, 1947, **43**, 708–715.—Eyring's theory of rate processes as applied to the visc of paraffin hydrocarbons is outlined. The energetic equivalent of the existent holes is evaluated, and the difference between it and the cohesional forces of the paraffin chains is found to correspond fairly well with the observed value of $\Delta H^{\circ}_{vap.}$. Attention is drawn to the inadequacy of the data on latent heats of evaporation of the hydrocarbons. E. B.

Analysis and Testing.

1435. Kellogg's Pilot Plant Laboratory Researches Widely in Petroleum and Chemical Fields. A. L. Foster. *Oil Gas J.*, 29.7.48, **47** (13), 224.—Divisions of the M. W. Kellogg Co. laboratories in Jersey City are described.

The pilot-plant division has four main groups: operation, design and engineering, maintenance and construction, and office and stores. The heavy-oils division is responsible for all work on heavy petroleum products including catalytic and thermal cracking, lub. oil refining, coking, propane deasphalting.

Pilot-plant is available for the various works, and includes a pilot plant of two 40-in × 40-ft extraction towers for the propane deasphalting process.

The light-oil and gas division deals with naphthas and lighter petroleum products and gas processes including hydroforming, thermal-reforming, and hydrocarbon-synthesis operations.

The organic chemistry division is the fundamental research laboratory of the organization, and deals with small-scale studies on all chemical matters, analytical and operational problems and literature surveys and studies incident to the other research programmes.

An organization chart of the petroleum and chemical research department is given. G. A. C.

1436. Review of Laboratory Fuel-Oil Stability Tests. A. R. Rescorla and D. V. Trew. *Oil Gas J.*, 29.7.48, **47** (13), 238.—Comparisons between known and published test methods and newer methods developed for determination of stability are given. A resin test developed in the laboratories of the Cities Service Oil Co. is described; and the acid-flocculation test discussed.

It is believed that the resin and acid-flocculation tests are reliable laboratory procedures for the empirical rating of fuel oils. An appendix gives eight methods of test, and eight tables illustrate the article. G. A. C.

1437. Measurement of Gas Temperatures by Means of Thermocouples. W. L. Bolles. *Refiner*, Feb. 1948, **27** (2), 120.—Errors in gas-temperature measurements may be reduced by the application of ordinary laws of heat transfer. This is achieved by an increase in the heat convection between the thermocouple and the gas and by decreasing the conduction between the couple and its support and also the radiation between

the couple and the surrounding surfaces. Large errors are usually caused by poor heat transfer between the gas and the couple, heavy thermocouple protection, and short supports. On the other hand, bare couples with low heat conductivity, long and narrow supports, and the use of radiation shields will increase the accuracy of measurements. Thermocouples of high-velocity type are recommended for measurement of temperatures in the high ranges. J. T.

1438. Practical Engine Room Tests of Lubricating Oil Contaminants. F. L. Gerin. *Diesel Pwr Diesel Transportation*, July 1948, **26** (7), 60.—The author describes the significance and simplicity of the important lub. oil tests for sediment, viscosity, and acidity which can be carried out by the engine operator with the aid of newly developed equipment. The author points out that continuity of testing is important for practical oil evaluation, and states that variation in the rates of oil contamination is a sensitive means of determining incipient engine troubles. C. D. B.

1439. A Further Study of Smoke and Odor. Anon. *Diesel Pwr Diesel Transportation*, May 1948, **26** (5), 62.—Comments are taken from an S.A.E. Paper by S. R. Whetmiller and L. E. Endsley, Jr., entitled "Diesel Smoke and Odor," based on a paper presented by the former at the Beacon Laboratories of the Texas Co., on the occasion of a visit there of the Diesel Engine Manufacturers Association. The paper describes tests in an engine on thirteen fuels to trace the cause of exhaust smoke and odour formation.

With particular emphasis on low output conditions, the authors found that exhaust smoke decreased with increase in cetane number and volatility. In all cases where white smoke was obtained liquid fuel was present in the exhaust system. Smoke at high loads was predominantly black from unburnt carbon particles in the exhaust gas.

With respect to odour, this was dependent on the presence of "aldehydes" in the exhaust, which were lower in high-cetane fuels; the exhaust odour therefore depended on cetane number, which was a reflection of the ability of the fuel to support combustion. Odour resulting from "weak" or light load running (*i.e.*, near the limit of combustion), was easily recognized from that derived from high load or "rich" operation. Liquid fuel which had collected in the exhaust system while running on light loads contributed to exhaust smoke, but not significantly to exhaust odour.

The authors conclude that it is not possible to obtain perfect results over a wide load range from a single fuel without resource to additives, but think that future engine design will obviate the necessity of tailor-made fuels and precise maintenance practices. C. D. B.

Crude Oil.

1440. Analyses of Crude Oils from 283 Important Oilfields in the United States. C. M. McKinney and O. C. Blade. *U.S.B.M. Rept. Invest.* 4289, May 1948.—Detailed analyses are presented of crude oils from 283 of the 340 oilfields in the United States which produce 2500 b.d. or more. Where necessary two analyses from each field are given and cell analyses are made by the U.S.B.M. routine method. G. S.

1441. Bibliography of Reports Containing Analyses of Crude Oils by the Bureau of Mines Routine Method. E. Hughes and O. C. Blades. *U.S.B.M. Inf. Circ.* 7470, June 1948.—A compilation of references to 115 publications in which analyses of crude oils by the U.S.B.M. routine method are given. An extensive index provides a rapid reference to the required publication. In addition to crudes from the U.S.A., some from Canada, Mexico, and countries of South America, Africa, Asia, East Indies and New Zealand, and Europe are listed. G. S.

Engine Fuels.

1442. Colloidal Fuels for Diesels. M. L. Khanna. *Gas Oil Pwr*, 1948, **43**, 243.—Indian vegetable oils (particularly cotton-seed oil) can be successfully employed as diesel fuels, but their cost is much greater than mineral oil. If the vegetable oil can be used as a base for powdered solid fuel, the cost will be less and the resulting oil may be able to compete with mineral oil. To this end charcoal of particle size 20μ was blended into groundnut oil with the addition of a stabilizer, and it was found that

a 35% suspension could be stored for lengthy periods and would flow through an engine-fuel system quite easily. The colloidal fuel formed only a very narrow cone when injected with Bosch-type equipment into a single-cylinder Lister engine, and although the results were promising, experiments had to be discontinued because of wear caused by the colloidal particles to the injection system. H. C. E.

1443. Blending Methods in the Preparation of Motor Fuel. F. D. Fuqua. *Refiner*, Feb. 1948, **27** (2), 108.—Simple methods are described for a rapid calculation of T.E.L. requirements of straight, cracked, and reformed gasolines from their clear octane numbers. Examples for estimation of octane number and vapour pressure of a blend, also its percentage distilled-over from corresponding properties of its components are given. J. T.

Gas Oil and Fuel Oil.

1444. Heating Oil Quality Trends. S. H. Hulse and J. O. Collins. *Fuel & Oil Heat*, July 1948, **7** (3), 63.—Statements published have implied that catalytically cracked fuels are inferior to those derived from thermal cracking, but the authors' view is that satisfactory results can be obtained from catalytically cracked fuels if they are processed and blended with the same care as those which are thermally cracked.

The characteristics and fuel requirements of three domestic-burner types, namely, pressure-atomizing-gun, rotary-wall-flame, and vaporizing-pot types, having different sensitivities are reviewed and a description given of tests carried out on them at thirty-four laboratories to determine what changes in fuel-oil specification would be desirable in order to follow the expected trends in fuel quality.

For the purpose of these tests the A.S.T.M. Technical Committee E on Burner Fuel Oils selected two reference burner fuels, No. 1 composed of 25% catalytic distillate and 75% straight run, and No. 2 composed entirely of catalytic distillate representing the minimum burning quality that could be foreseen in the light of changed refining processes. It was concluded that neither reference oil, nor blends thereof, were satisfactory for vaporizing-pot type burners, but either could be burned satisfactorily in high- or low-pressure atomizing-gun type. Existing installations of wall-flame burner might require some changes in hearth design to burn No. 2 fuel. As these fuels were inferior to oils of expected competitive commercial quality, there need be little concern for the future supply of heating oils.

A table is presented detailing the requirements of fuel oils as outlined in the revision of A.S.T.M. burner-fuel-oil specification D-396-48T. C. D. B.

1445. Boiler Fuel in Diesel Engines. Anon. *Motor Ship*, Sept. 1948, **29**, 221.—A short discussion is given of the possibility of using boiler fuel in diesel engines and includes a diagrammatic sketch of the layout of plant for the purification of boiler fuel. I. G. B.

Lubricants.

1446. Some Mechanical and Organizational Aspects of Lubrication Research in the U.S.A. H. Blok. *Ingenieur*, 20.8.48, **34**, Mk 99–102.—Lubrication research in the U.S.A. only deals with those mechanical aspects which will give a fundamental insight into lubrication and which will lead to a new basic approach to the construction of journal and sliding bearings and of transmission gears. The following points are briefly discussed: (1) influence of the pressure variation of the viscosity of oils on the load-carrying capacity of machine parts; (2) new principles of pressure formation in oil films; (3) load-carrying capacity of bearings under fluctuating loads; (4) interrelationship between the following bodies: (*a*) C.F.R.; (*b*) S.A.E.; (*c*) C.L.R. (Co-operative Lubricants Research); (*d*) C.R.C.; (*e*) N.A.C.A. (National Advisory Committee for Aeronautics); (*f*) S.L.E. (Society of Lubrication Engineers). N. C.

1447. Modern Lubricating Oils. B. Kasiński. *Nafta*, Feb. 1948, **4**, 68–71 (reprinted from *Przegląd Motoryzacyzny*, June 1946).—Describes modern methods of improving viscosity, V.I., lubricating properties, stability, oxygen resistance, corrosiveness, prevention of emulsification, and de-waxing, of lubricating oils. Also considered is the effect of dilution of lubricating oil by gasoline on its pour point and consumption.

Addition of small percentage of special synthetic chemicals has beneficial effects. A comparison between lubricating oils used in the U.S.A. before the war, at present, and those of the future is included at the end. M. S.

1448. Report on Work of Liquid Fuels and Lubricants Committee of the Polish Standardization Commission for the Year 1948. *Nafta*, Feb. 1948, **4**, 78.—Twelve sub-committees covering different groups of products submitted their reports at the end of 1947 to the Editorial Committee. These will be published as separate pamphlets which will make any changes easier. For 1948 it is planned to publish new methods of testing. The Committee receives a grant from Industry. M. S.

1449. Reclassification of Crankcase Oils to Reduce Refining Costs and Simplify Distribution and Supply. A. L. Foster. *Oil Gas J.*, 5.8.48, **47** (14), 70.—Several revisions of the partially obsolete crankcase lub.-oil classification have been proposed and are under consideration by a special sub-committee of Technical Committee B on Lubricating Oils, A.S.T.M. D-2.

The suggestion that the present grades of S.A.E. 20 to 70 be eliminated has been adopted and a new classification recommended.

A grade of crankcase oil lower in viscosity than 10-W for use in extremely low winter temperatures has been proposed.

The viscosity–temperature limits of proposed grades are tabulated. G. A. C.

1450. [Fuel] Filtration and the Oil Engine. W. E. W. Nicolls. *Gas Oil Pwr*, 1948, **42**, 245–247.—The high pressures and close tolerances of the injector pump necessitate the removals of solids from the fuel, otherwise damage to the equipment ensues. Neglect of fuel oil before it reaches the engine is a primary cause of its dirtiness. The requirements for a good filter are described, and the use of a fabric-element filter followed by a felt-element filter is recommended; in the C.A.V. filter both elements are combined within one container.

Filters should not be changed until they offer excessive resistance to fuel flow, and the exact period between changes is a matter for experiment; for some vehicles the period is 30,000 miles. The cleaning procedures for the fabric type, where the element is discarded, and the felt type where the element is washed with fuel oil followed by petrol, are described, and emphasis is laid on the necessity of carrying them out in a dust-free atmosphere. H. C. E.

1451. Doped Motor Oils. C. Stillebroer. *Ingenieur*, 20.8.48, **34**, Mk 95–99.—The results of adding detergent dopes to motor oils is discussed. The cleanliness of the used oil and of the engine is dependent on the construction of the engine and its cooling arrangements. This cleanliness is very marked in the case of fast diesel engines, but not so marked for gasoline engines, the latter not becoming as dirty as the diesel engine.

Three graphs, three photographs, and three references are included. N. C.

1452. Detergent Oils for High-speed Oil Engines. A. T. Wilford. *Gas Oil Pwr*, 1948, **43**, 233–235.—The essential difference between a straight mineral oil and a detergent lub. oil is that the latter contains as additives chemical compounds which function as oxidation inhibitors, preventing oil oxidation, and anti-flocculants, preventing coagulation of the carbonaceous particles formed during combustion. Some of the additives cause corrosion to lead–copper and cadmium–silver bearings, so corrosion inhibitors are also included. A detergent oil can be proved superior to a straight oil only by test in an engine, and detergent oil is not classed as H.D. oil until it has passed five stringent engine tests, two of which continue for almost 500 hr.

Detergent oils minimize the ring-sticking, lacquering, and sludge formation which occur particularly when engines are run at maximum output. London Transport is now testing detergent oils on a large scale, and although final results have not yet been obtained, the tests suggest that engines using detergent oil give 30% greater mileage than do corresponding engines operating on straight mineral oil. Detailed instructions for changing from one type of oil to the other are given, and emphasis is placed on the importance of conducting any tests on a representative proportion of a fleet of vehicles. H. C. E.

Bitumen, Asphalt, and Tar.

1453. Soil Stabilization, Subgrades and Sub-bases. Anon. *Roads & Streets*, June 1948, **91** (6), 93.—The use of local materials, stabilized where necessary, is advised for subgrades and sub-bases, but it is stressed that clay is a very poor base material.

Soil–aggregate mixtures having a liquid limit greater than 25 or a plasticity index greater than 6 should never be directly covered by a watertight bituminous surface.

Use of sand to reduce plasticity index is seldom economical; usually cheaper to cover with an appreciable thickness of sand.

Tests in Texas indicate possibilities of use of lime in stabilization of plastic fine-grained soils.

Tars, emulsions, and asphalts have been used in soil stabilization without addition of granular materials, but addition of latter is more economical. G. A. C.

1454. San Francisco Soils and Equipment Conference. Anon. *Roads & Streets*, May 1948, **91** (5), 55–58, 110.—250 delegates attended the Western States Conference on Compaction of Soils and Development and Use of Highway Construction Equipment, on April 8–9. Soil compaction was fully discussed in relation to types of soil and economics. It was agreed that specifications are still imperfect and specifications in Washington, New Mexico, and California were reported on.

Soil equipment was reviewed with reference to vibratory rollers, sheepsfoot, smooth and pneumatic rollers, boring and sampling equipment. Special units included a truck-mounted boring rib, assembled with a Buda drill unit on the back of a truck; a small Jeep-mounted post-hole digger-type unit, and units with seismograph and electrical-resistance equipment for determining rock character. W. M. H.

Special Hydrocarbon Products.

1455. The Formation of Insecticidal Films on Building Materials. III. Supplementary Laboratory Tests on Size and Gelatin as Pretreatments. P. S. Hewlett. *Annals appl. Biology*, 1948, **35** (2), 228–232.—Further tests have been made with size and gelatin as pretreatments to prolong the toxic life of insecticidal films, using *Tribolium castaneum* as the test insect. The insecticides used included pyrethrins and D.D.T. in Shell Oil P.31. Results show that pretreatment of cement with 10% size or 5% gelatin increases the persistence of most insecticidal films, gelatin being superior to size in this effect. Films formed by 1·6% pyrethrins and 1·0% D.D.T. are in general more toxic than the others.

The effects of adding other substances to the size and gelatin were also investigated. Of these, lime and distemper powder lessen the effect; magnesium silicofluoride, benzoic acid, and salicylic acid are suitable as preservatives, but cause precipitates to form; glycerin or turkey-red oil at concentrations of 0·5% v/v appear suitable as plasticizers. There are four literature references. W. M. H.

1456. The Fungistatic Activity of Ethylenic and Acetylenic Compounds: I. The Effect of the Affinity of the Substituents for Electrons upon the Biological Activity of Ethylenic Compounds. J. C. McGowan, P. W. Brian, and H. G. Hemming. *Annals appl. Biol.*, 1948, **35**, 25–35.—Tests for fungistatic activity have been made on eighty-one compounds, using *Fusarium graminearum*, *Penicillium digitatum*, and *Botrytis allii* as test organisms. Results, which are presented in tabular form, indicate that the greatest activity is shown by compounds in which a strongly electron-attracting group is attached to one of the double-bonded carbon atoms, electrons being withdrawn from the double bond. Examples cited are nitroethylenes and fumarates. Nine references are given. W. M. H.

1457. The Fungistatic Activity of Ethylenic and Acetylenic Compounds: II. Esters of Halogenofumaric Acids and Acetylene Dicarboxylic Acid. J. F. Grove. *Annals app. Biol.*, 1948, **35**, 37–44.—Methods of preparation and results of tests on fungistatic activities are described for a number of compounds of the types mentioned above. Their mode of action is discussed. The lower halogeno- and thiocyanofumarates and acetylene dicarboxylates proved to be highly fungistatic. There are twenty-one literature references. W. M. H.

1458. Liquid Paraffin in Baking. J. B. M. Coppock and R. C. A. Bradshaw. *Brit. Med. J.*, 1948, ii, 401.—Cake batter made with liquid paraffin still contains, after baking, some liquid paraffin particles of 0·5μ, despite some aggregation of the initially finely dispersed liquid paraffin which, prior to baking, contained about 30% of particles of this size. In view of possibilities of liver damage by absorption of mineral oil when dispersed to such a degree further investigation is desirable; particularly as the action of emulsifiers present in the bowel may, after ingestion, increase the number of mineral-oil particles <0·5μ. V. B.

Derived Chemical Products.

1459. Detergents from Petroleum. B. H. Weil. *Refiner*, May 1948, **27** (5), 126.—A general review of the field of detergents with special emphasis on those produced from petroleum is given. A vast number of detergents synthesized from petroleum are described, and in many cases the production figures and other statistics of some of the leading manufacturers in this field are mentioned. About fifty references are given. J. T.

1460. Chemicals from Petroleum. J. E. Bludworth. *Petrol. Engr*, July 1948, **19** (10), 146.—The existing possibilities in the production of secondary products from aldehydes is considered, the aldehydes being obtained from natural gas. The reactions considered are the formations of aldols, acetals, and esters, aldehyde condensations catalysed by acids, and oxidation of aldehyde to acids and alcohols. Further secondary reactions with aldols give by dehydration, unsaturated aldehydes, by hydrogenation glycols. The latter by dehydration will give dienes. A simple flow sheet is given. G. K. A.

Coal, Shale, and Peat.

1461. Conversion of Coal to Oil and Gas. F. A. Howard. *Min. & Metall.*, July 1948, **29** (499), 388.—Reasons for the present interest in the synthetic fuel industry are: (1) recurrent seasonal and spot shortages of petroleum products; (2) international situation; (3) long-term economic and military problems.

Statistics of fuel reserves indicate that solid fuels must be regarded as the basic fuel reserve.

Development of the industry in the U.S.A. was prevented by the ample supply and low cost of liquid fuels, and development occurred mainly in Germany.

Processes investigated were distillation, producer- and water-gas operations culminating in the hydrogenation processes of Bergius and the catalytic Fischer–Tropsch process. The expansion of these processes in Germany and the U.S.A. is described. The necessity for supplies of toluene and gasoline blending agents was responsible for the U.S. interest during the late war. The future outlook for the industry is discussed and the economics of a synthetic project tentatively outlined. A discussion is appended. C. G. W.

1462. Oil-Shale resources of Colorado, Utah and Wyoming. C. Bolser. *Petrol. Tech.*, May 1948, **11**, *A.I.M.M.E. Tech. Pub. No.* 2358 (3), 1–11.—A limited number of sampled sections of the Green River oil-shale group indicated that Colorado, Utah, and Wyoming have, respectively, 300,000, 42,800, and 3,000 million brl of shale oil. The oil content of at least 50% of the area in Utah and 90% of the area of oil-shale occurrence in Wyoming is unknown. There are indications that the oil-shale zones are richer in the centres than on the margins of the old basins. The Green River formation is 300 ft thick and is divided into four members which vary in the content of oil shale, and differ in different areas. Generally the oil shale is a tough magnesium marlstone. Fresh shale has been found to have about 15% more oil than corresponding weathered sections. Some samples have shown over 30 gal oil per ton.

The location of the points of sampling are shown, and graphic sections show the oil yields from drill-hole samples in the Piceance Creek Basin. G. D. H.

Miscellaneous Products.

1463. Dermatological Action of Skin Cleansers. L. Schwartz. *Soap & Sanitary Chemicals*, May 1948, **24** (5), 33–36.—Chemical composition, properties and mode of

action of various types of soap are briefly discussed. Soaps are mild antiseptics, and substances may be added to increase their antiseptic powers. These additives may give rise to allergic dermatitis, as may also many soap perfumes, such as oil of cassia and cloves.

Soaps tend also to defat the skin and to cause eczema, particularly with thin dry skins. This is very noticeable when cocoanut oil, fish oil, rosin, and foots are used, but a sufficiently superfatted soap may counteract this property to some degree. Indicator soaps are being developed, which will neutralize dangerous chemicals on the skin and also show their presence by a colour change.

Synthetic detergents can be made less alkaline than soap, but on the other hand are more defatting and cause more allergic reactions. The quaternary ammonium compounds have marked fungicidal and disinfectant powers, and are now used in antiseptic dressings.

For dermatitis sufferers, the source of irritation is identified by patch tests, and a soap prescribed which does not contain the offending materials.

Eight literature references are given. W. M. H.

1464. Synthetic Chemicals for Agriculture. Part 1. Fertilisers and Insecticides. R. H. Wellman. *Chem. Ind.*, June 1948, **62** (6), 914.—Statistical survey has disclosed that due to economic reasons, demand for organic chemicals as fertilizers and insecticides is likely to increase above its already high level.

The range of application conditions is wide and, due to the relatively specific nature of most toxic compounds and their undesirable effects under certain conditions, a large number of organic insecticides and fertilizers has had to be developed.

This article deals with the properties of the more well-known chemicals for this purpose and the methods by which they are applied. In addition, a list of the newer insecticides and their prime manufacturers is given. O. M.

1465. Fuels and Lubricants from Sources other than Petroleum. G. T. Perry. *Canad. Chem. Proc. Ind.*, July 1948, **32** (7), 624.—By utilization of synthetic processes it has been estimated that Canada can become independent as regards liquid fuels and lubricants.

The two main processes available for liquid-fuel production are known as Hydrocol and Synthine. Both are based on the Fischer–Tropsch process, the difference being that the former is designed mainly to utilize natural gas while the latter is more flexible and can process synthesis gas obtained by any commercially practical method.

For lubricants production the chief processes available are the hydrogenation of coal, utilization of the end-products of the Fischer–Tropsch process for blending or for subsequent treatment by the Polymerization Process and, finally, the O.X.O. process which involves the reaction of olefins with water-gas over Fischer–Tropsch catalyst. Various other processes, such as Voltolization (polymerization under influence of an electric field) are also available and act as minor sources of lubricants along with such materials as " Ucon " and shale-oil products. O. M.

Engines and Automotive Equipment.

1466. Magnetic Filters on New Diesel-electric Locomotives. Anon. *Amer. Mech. World*, 20.8.48, **124**, 223.—To eliminate ferrous contamination of lubricating oil in British Railways' new locomotives, and lengthen life of the oil, magnetic filters are used. The magnets are surrounded by cages to which the ferrous particles adhere. These cages are easily removable and allow cleaning operations to be carried out in five minutes. O. M.

1467. The M/V " Willem Ruys." D. T. Ruys. *Ingenieur*, 16.7.48 (29), W 73–87.—Fully described and illustrated by line drawings are the 30,000-h.p. diesel engines, the gears, and the electro-magnetic couplings, together with the main auxiliary engines (*i.e.*, three diesel driven generators of 1000 kW each; one generator of 530 kW and one turbo generator of 600 kW each using the steam of four waste-heat boilers heated by the exhaust gases of the main engines.

The fresh-water supply of the vessel, the heating of the fuel and lubricating oil, the laundry equipment, the air-conditioning plant, and the heating of the public rooms are all serviced by the steam from the waste-heat boilers. A refrigeration plant consisting of three ammonia compressors is also installed.

A full description of the electrical installation is given.

Twenty-one drawings and photographs are included. N. C.

1468. Design Trends for Future Diesel Engines in India. M. Somaya. *Diesel Pwr Diesel Transportation*, June 1948, **26** (6), 94.—India must have heavy industry to raise her standard of living and the need for cheap motive power is therefore paramount. Attention is directed to diesel power for which the present and future demand is great. The present shortage is due to the worn-out condition of those engines at present in use and the fact that Britain, of whom India was the greatest importer of small engines of from 5 to 100 h.p., could now supply only about half the pre-war number of 45,000 units per year, having a value of approximately $2,000,000. Larger medium-speed engines of from 100 to 1000 h.p. were obtained, mostly from Germany and Czechoslavakia.

American competition in the Indian market was therefore unchallenged, but it had to be appreciated that the market requirements were for engines of the greatest simplicity, having a speed range of 300–400 r.p.m. for low powers, and 600 r.p.m. above 100 h.p., the smaller engines being horizontal types similar to those previously supplied from Britain. American engines of the high-speed type were not at present acceptable, and American diesel builders were advised to concentrate on simple medium-speed engines for the Indian market. Of the larger engines four-stroke types were preferred, since Duetz four-cycle engines had given better service than the two-stroke engines of Krupp and M.A.N. C. D. B.

1469. Experimental Compound Diesel Engine. Anon. *Gas Oil Pwr*, 1948, **43**, 206.—The cylinder element of the Mitsubishi compound engine consists of one two-stroke low-pressure cylinder and two four-stroke high-pressure cylinders. The dimensions of the high-pressure cylinders are 100 mm dia and 200 mm stroke; those of the low-pressure cylinder 200 mm and 250 mm. Other specifications are: r.p.m. 1500, b.m.p. 8 atm., b.h.p. 210, weight 0·6 tons, injection started 40° before and ended 20° after t.d.c.

The transfer valves, passing gases from high- to low-pressure cylinders, gave trouble because of the high temperatures (1200–1300° F) to which they were exposed. It was thought that, in its present form, the engine could not develop more than 150 h.p. because of combustion difficulties. (Taken from BIOS Report JAP/PR/1296.)

H. C. E.

1470. Italian Small Marine Diesel. Anon. *Gas Oil Pwr*, 1948, **43**, 252.—This unit has four cylinders each of diameter 165 mm and stroke 225 mm. Maximum output is 100 b.h.p. at 750 r.p.m., and on continuous rating 80 b.h.p. at 600 r.p.m. Specific fuel consumption is 165 g/b.h.p.hr. The construction of the engine is briefly described. H. C. E.

1471. American Oil Engine Practice. J. Jones. *Gas Oil Pwr*, 1948, **43**, 195–205.—This article summarizes U.S.A. progress made of recent years in the design of oil engines (excluding marine engines) and in manufacturing technique. The types of engine described are: Alco (rail diesel units), Worthington (dual-fuel engines), Sterling, Clark (gas engines), General Motors, Nordberg, Waukesha, Fairbanks-Morse (two-stroke opposed-piston units), Caterpillar, Superior, and Cooper-Bessemer (dual-fuel engines). Outstanding models of each type are briefly mentioned, and any unusual or elegant techniques are described.

Eleven diagrams and photographs illustrate the article. H. C. E.

1472. Large Dual-fuel Engines in the States. Anon. *Gas Oil Pwr*, 1948, **43**, 227–232.—The Superior dual-fuel engines have cylinders 14¼-in by 20-in and develop 120 b.h.p. per cylinder, equivalent to a b.m.p. of 80 p.s.i., when running at 360 r.p.m. They run on diesel fuel or natural gas, and when pressure-charged the output is

increased by up to 56%. The pistons are oil-cooled, and a Bendix-Scintillia fuel-injection pump is fitted to each cylinder.

When running on natural gas, which is compressed in the cylinders to 400 p.s.i., a pilot injection of diesel oil must be added to ignite the main charge. The quantity of pilot fuel lies between 5 and 18% of the fuel required for full-load diesel operation. The controls are so arranged that the operation of push-buttons changes the fuel from oil to gas or vice versa, and when gas is used supply the fuels in the correct proportions by means of governor controls, the action of which is described in full. In using the engine the cooling-water must be kept at the correct temperature, the gas-delivery pressure must be about 4½ to 6 in water head, and the pilot oil must be just under the no-load diesel setting on a hot engine.

When pressure-charging is applied the gas pressure must always exceed the charging-air pressure, and the regulator which adjusts this pressure is described. The text is illustrated by seven line figures and diagrams. H. C. E.

1473. British Engine for Natural Gas Burning. Anon. *Gas Oil Pwr*, 1948, **43**, 241.—This is the first gas engine to be built entirely of oil-engine parts, and considerable saving in construction costs is obtained. Its output using oil fuel is 55 b.h.p. per cylinder at 428 r.p.m., and as modified for gas burning it is 64 b.h.p. at 500 r.p.m. The performance of the engine in relation to its b.h.p. at 500 r.p.m. is illustrated by graphs, and the full-load consumption of 7500 B.Th.U. is equivalent to an oil engine with a consumption of 0·4 lb/b.h.p.hr. The arrangement of an air and gas governor valve to each of the five cylinders gives constant mixture ratio and the highest efficiency at fractional loads. H. C. E.

1474. Hercules High-speed Vee Engines. Anon. *Gas Oil Pwr*, 1948, **43**, 213.—The three models of these engines vary only in the piston diameters; 5¾, 6, and 6½ in. Other specifications are: 8 cylinders of 6-in stroke, r.p.m. 2100, maximum b.h.p. 340–400 depending on piston diameter, when naturally aspirated, and 25% greater when pressure-charged. The compression ratio is 14·8 : 1. Graphs illustrate the variation of b.h.p., torque, and fuel consumption with r.p.m. for the largest engine, both naturally aspirated and pressure-charged. Combustion air is tangentially compressed into an auxiliary chamber, into which fuel is injected so that thorough mixing is obtained and the rate of combustion gives the greatest power output compatible with fuel economy.

The two Bosch four-ram injection pumps are driven by the camshaft, and the fuel delivery is automatically controlled by a hydraulic governor. The engine is cooled by water thermostatically controlled and circulated by means of a centrifugal pump. H. C. E.

1475. Napier Naiad. Anon. *Flight*, 12.8.48, **54**, 180.—This is the most recent of British air-screw turbines, and excellent sketches of the structural details are given. Leading particulars are :—

Maximum diameter	28 in
Length	88 in
Net weight	1095 lb
Oil consumption	1 pt/hr.

Also given are maximum power curves against altitude with fuel consumptions at the various conditions. I. G. B.

1476. Application of Gas Turbines to Aircraft. A. Tifford. *Aerol Engng Review*, July 1948, **7**, 33.—The algebraic expressions relating to gas turbine operation yield interesting results when this type of engine is applied to aircraft. The author gives a comparison of the performance of different types of engines at maximum cruising altitude of 35,000 ft. I. G. B.

1477. The Oerlikon 1000-kW Open-cycle Machine. Anon. *Oil Engine & Gas Turbine*, Mid-July, 1948, **16** (183), 96.—The 1000 kW gas turbine set at Zurich-Oerlikon, of Maschinenfabrik Oerlikon was installed in 1946, and has since completed 4000 hr running.

Constructional details of the machine are described. The three-stage centrifugal type compressor runs at 4500 r.p.m. Each stage delivers air into four equally spaced partial spirals succeeded by a straight diffuser, which reduces the absolute speed of the air from 656 to 132 ft/sec. Interstage cooling, using water-cooled tube packs, is practised, giving an internal efficiency per stage of 88%, with a compression ratio of about 4 : 1. Air from the compressor passes through a seven-pass multi-tube heat exchanger to the horizontal combustion chamber, which it enters at about 300° C.

The combustion chamber is made of Swedish steel with a refractory lining. One-seventh of the air enters around that burner, while six-sevenths are admitted as dilution air, the resulting gas at 550° C passing to the five-stage high-pressure turbine which drives the alternator. Gas at about 480° C from the high-pressure turbine passes to the five-stage low-pressure machine which drives the centrifugal compressor and thence at about 350° C through the heat exchanger to atmosphere, or to perform other useful work in the heat plant.

A special control system giving close governing of speed is described.

The set has operated on a wide range of fuels, from bunker C to lighter oils, without appreciable difference in fuel consumption. C. D. B.

1478. Gas Turbines for Railroads. Anon. *Diesel Pwr Diesel Transportation*, May 1948, **26** (5), 70.—The article deals with the application of gas turbines in the railroad locomotive field, and describes a General Electric gas turbine for locomotive application exhibited at Schenectady. Rated at 4800 s.h.p., the unit runs at 6700 r.p.m. with a turbine inlet temperature of 1400° F, and is designed for an altitude of 4500 ft and ambient air temperature of 80° F. The nett overall thermal efficiency, based on the lower heating value of bunker C fuel, is better than 17%. Pulverized coal is also being considered as a fuel.

The principal design features are a 15 stage axial flow compressor having a capacity of approximately 70,000 cu. ft./min. and a pressure ratio of about 6 : 1. The six combustion chambers, each made up of four annular sections of carbon steel, with an inner liner of stainless material, are approximately 35 in long and 10 in diameter. Fuel nozzles of the air-atomizing type are employed, drawing their air from a separate small compressor. Ignition is effected by spark plugs in two of the chambers, the others being ignited through cross-ignition tubes. The turbine, which discharges to atmosphere through a diffusing exhaust hood, consists of two stages, each wheel of which is composed of suitable stainless material for the rim, with the main central portion composed of low-alloy high-strength steel suitable for operation below 700° F. Constructional details of the complete machine are described, and it is estimated that 100 h.p. will be necessary for starting, probably obtained from a diesel-engine generator set supplying power to one of the main generators.

Certain operating problems which were exposed during the Westinghouse tests are described.

Mention is also made in the article of a conventional gas turbine of 2000 h.p. being developed by Westinghouse, and a "free-piston" gas generator set developed in collaboration with the Lima-Hamilton Corpn, the turbine of which is expected to develop 3000 h.p. Performance tests on the gas turbine have indicated an overall fuel consumption at full load of 0·78 lb/b.h.p./hr, based on a fuel with a heating value of 19,550 B.Th.U.s/lb, but it is believed that a simple open-cycle gas-turbine power plant of larger capacity could be built having a fuel rate of 0·6 lb/b.h.p./hr.

C. D. B.

1479. Helicopter Research. J. A. J. Bennett. *Ingenieur*, 9.7.48 (28), L32–36.—The success of the helicopter is a result of a background of rotary-wing experience. The necessity for control simplification has led to devices for governing rotor pitch or engine speed. In the past, propellers were mounted on the rotor blades to produce thrust at the blade tip, but recently blade-tip jets have enabled vertical flight to be attained by an aircraft designed to fly normally as an autogyro. The principal defect of blade-mounted jets is that of fuel consumption, and if and when solved, jet propulsion of helicopter rotors may become a practical proposition for large helicopters; twin rotors mounted in tandem and possibly intermeshed appear to be the most straightforward arrangement for future developments.

Eight charts and photographs are included. N. C.

1480. Symposium: The Engining of Cargo Vessels of High Power. *Trans Inst. mar. Engrs*, 1948, **59**, 243.—*The Geared Steam Turbine*, by T. W. T. Brown. Fuel burned under boilers can be of very low grade and whilst fuel-consumption figures are quoted in weight or volume, the lower calorific value of such fuels, compared with diesel fuels, increases the specific consumption figure for turbine machinery although such low-grade boiler oil is much cheaper than diesel fuel. Fuel consumptions quoted are: 7500 s.h.p. 49 tons/24 hr, 13,000 s.h.p. 75·2 tons/24 hr, 13,000 s.h.p. with 1400 p.s.i. steam pressure 72·3 tons/24 hr.

The Direct Coupled Diesel Engine, by C. C. Pounder. A 7500 s.h.p. single-screw engine was quoted to have a main-engine consumption of 30 tons of fuel oil per 24 hr with auxiliary diesel engines taking 3 tons/24 hr. A 13,000 s.h.p. twin-screw main engine consumption of 52 tons/24 hr is given with approximately 4·5 tons/24 hr for auxiliaries. These were average service figures.

Lub.-oil consumption in such installations vary widely from ship to ship. Figures quoted were, perhaps, over-generous, *e.g.*, 7500 s.h.p. single-screw, main-engine crank-case-oil consumption 18–24 gal/24 hr and cylinders 14–18. Auxiliaries 8. Total, therefore, 40–50 gal/24 hr. 13,000 s.h.p. twin-screw, total consumption quoted was 62–72 gal/24 hr made up as: main-engine crankcase 26–32, cylinders 24–28, auxiliaries 12.

It is characteristic of the diesel engine that over its lifetime its fuel economy remains constant. This is not true of steam machinery, *e.g.*, one fleet of high-class steamers deteriorated in fuel economy 1% per annum, *i.e.*, in 10 years fuel consumption was 10% more than when new.

The Geared Diesel Engine, by C. C. Pounder. While relatively small, fast-running engines may have a fuel consumption per b.h.p. of 5 or 6% more than for large engines, the engines mentioned in this paper, 7500 s.h.p. and 13,000 s.h.p., have consumptions no higher than the direct-coupled engines given in the first paper.

Total lub.-oil consumption quoted for trunk-type pistons are 53–58 gal/24 hr for 7500 s.h.p. and 87–92 for 13,000 s.h.p. Crosshead-type engines take 45–50 and 70–75 respectively. All these amounts are capable of reduction.

In general, geared diesel engines can be expected to consume 5% more fuel than direct-coupled engines for the same tunnel s.h.p.

Diesel Electric Propulsion, by J. G. Belsey and J. G. Robinson. Service pumps directly driven from the engine are stated to be a source of trouble, and the scheme put forward for the lub.-oil system proposes a common-rail system with careful designing of pipelines to ensure little impedance to flow at any point. This arrangement permits the quality of the lub. oil to be kept the same in all engines and simplifies handling for cleansing treatment.

Turbo Electric Propulsion, by C. W. Saunders and T. H. Turner. For a 7500 s.h.p. turbo-electric single-screw single-turbo alternator, calc. fuel-oil consumption was 0·640 lb/s.h.p./hr, using steam for auxiliaries, but this could be reduced to 0·618 lb/s.h.p./hr by using diesel auxiliaries. With two turbo-alternators a 4% higher fuel consumption would be expected.

A 13,000 s.h.p. installation would have a turbo-alternator efficiency 2% better than the 7500 s.h.p.

The Combustion Turbine, by J. Calderwood. Considerable time has been spent in fuel tests, from which it appears that the danger of fouling of the installation lies mainly in incomplete combustion. Therefore, if good combustion can be maintained, the heavier grades of fuel should be satisfactory. Even if it is found that the combustion turbine cannot work satisfactorily on the heavier grades of fuel, it would still be an attractive proposition commercially, with an efficiency of about 35% and the small dimensions and low weight shown in the design put forward in this paper.

Summary of Papers, by S. F. Dorey. It is recalled that experiments directed towards the use of the boiler fuel in diesel engines are not a new departure, and a fleet of vessels using such engines was in operation just before the war. One reason for the recent revival of interest is the increasing use of diesel fuel on land.

Comparing the fuel consumptions of the various installations discussed the geared steam turbine is taken as 100%. The following figures apply: 7500 s.h.p.—steam turbine 100%, diesel 67%, geared diesel 71%, diesel electric 74%, turbo-electric 103%. 13,000 s.h.p.—steam turbine 100%, 1400 p.s.i. turbine 96%, diesel 75%, geared diesel 80%, diesel electric 82%, I.C.T. 84%, I.C.T.—electric 87%.

Lub.-oil consumption varies from 1·7% weight of the fuel-oil consumption in the worst case of the diesel electric down to 0·1% with the I.C.T. Figures for the steam turbine are not given, but are stated to be small. The lub.-oil cost in the case of the high-speed diesel may, therefore, amount to appreciable percentage addition to the fuel bill. D. W. J.

MISCELLANEOUS.

1481. Evolution of Petroleum [Trade] Streams. A. Pierrey. *Rev. Inst. Franç. Pétrole*, 1948, **3**, 62–75.—A historical review of the geographical changes and expansion of petroleum trade from the mid-nineteenth century to the present day. The various principal trends during this period are illustrated by diagrams and brief tables of statistics. V. B.

1482. Last Half Demand 2·5 Per Cent Greater than that of First Half. E. T. Knight. *Oil Gas J.*, 29.7.48, **47** (13), 172.—The 1948 U.S. domestic and export demands for crude oil and products will average about 6¼ million brl daily and will be 6·5% greater than 1947 demands.

Domestic requirements for 1948 are estimated to average nearly 6 million brl and be 8·4% greater than 1947 domestic consumption.

Tables show demand and supply of petroleum products for 1948 and for 1949. G. A. C.

1483. First Half Production Barely Misses Reaching Even Billion Barrels. P. de Armond. *Oil Gas J.*, 29.7.48, **47** (13), 176.—The output of crude and condensate in the U.S.A. for the first half of 1948 totalled 998,157,000 brl, an increase of over 100 million brl over the same period of 1947.

Tables show U.S. oil production for the years 1941 to 1948 inclusive, production by locations for the first half of 1948, and daily average per well. G. A. C.

1484. Early 1949 Should Find Industry with 6-Million Brl Charging Rate. R. B. Tuttle. *Oil Gas J.*, 29.7.48, **47** (13), 201.—Catalytic-cracking processes continue to make up major part of the overall expansion programme; capacities will total over 6 million b.d. in early 1949.

New installations are nearly 10 times larger than revamping and modernization projects.

Tables show refining and petrochemical plant projects by capacity, status, completion schedule and contractors, and plants completed in second quarter of 1948. G. A. C.

1485. Petroleum Refining in the United Kingdom. H. Moore. *Canad. Chem. Proc. Ind.*, July 1948, **32** (7), 659.—An historical article relating how the increase in refining capacity in the United Kingdom has been controlled very largely by economics and military defence policy. The main arguments influencing the decision in favour of home refining are transport methods and costs. Latterly the development of the petroleum chemical industry has become an important factor in this connexion. O. M.

1486. [Polish] Petroleum Industry in Jan. 1948. Anon. *Nafta*, Feb. 1948, **4**, 79 (Report Section).—Figures are provided for production of crude, natural gas, unrefined gasoline, etc, during Jan. 1948. M. S.

1487. Development of National [Russian] Researches in the Field of the Chemistry and Chemical Technology of Petroleum. S. R. Sergienko. *Bull. Acad. Sci. U.S.S.R., Div. Tech. Sci.*, 1948, 855–872.—A survey of the principal Russian contributions to petroleum technology, during the period from about 1877 onwards; classified under the headings of: cracking, cat treatment of hydrocarbons, the composition and chemical properties of petroleum, physical and physico-chemical properties of

petroleum, and chemical refining. Thirty-three references, mostly to work published within the last 20 years. V. B.

1488. Fire-Retardant Paints, The Reduction of Fire Risks in Ships. Anon. *Paint Mnfr*, Mar. 1948, **18** (3), 84–87.—The mechanism by which an ordinary paint will spontaneously ignite if subjected to a sufficiently high temperature is described, and the formulation of a fire-retardant paint is discussed.

Considerable experimentation has shown: (1) that a primer pigmented with aluminium powder in leaf form is very effective. Its efficiency is due partly to its ability to form a very thin film, and mainly, the thermal conductivity of the metal ingredient spreading the heat evenly and so avoiding blister formation through local heating; (2) that for a top coating, titanium dioxide and antimony oxide outrival all other pigments in fire-retarding effect.

The experimental technique and method of evaluating fire-retarding paints, and large-scale trials carried out by the Admiralty departments, are described, and the specification for such paints is given.

The investigations of Dr U. R. Evans of Cambridge and his co-workers are widely discussed. The cementiferous paint invented by these workers is completely inorganic and consists of a zinc oxychloride cement containing a high loading of metallic zinc. The latter has an excellent anti-corrosive effect on steel surfaces. The advantages and disadvantages of this type of coating for Admiralty use as an interior paint are described. The most important disadvantage is that its two parts must be mixed just before use, and the mixture is thixotropic which causes it to leave brush marks, also its zinc component gives it a dull grey colour. Admiralty experiments to overcome these drawbacks are fully described and include the use of silicon ester and small amounts of organic plasticisers etc, but though slight improvements resulted, a really satisfactory fire-retardant paint for interior use had not so far eventuated.

It is concluded that the best solution of the problems met with in the formulation of an incombustible paint may still lie in overcoming the intractability of the silicon-ester paints. W. H. C.

1489. Protective Coverings for Marine Applications. R. Hammond. *Paint Mnfr*, Mar. 1948, **18** (3), 79–83.—The effects of fouling on the speed of vessels, and the American classification of world waters are discussed. The fouling characteristics of some seaport waters are described. Fouling takes place only when a ship is in port. Recent work has shown that velocities >1 knot will prevent settlement of the larvæ of the important fouling barnacles.

Calcutta and Matadi are known as "scouring ports" since a badly fouled vessel will be freed of fouling after only a short stay at these ports. Plant fouling and the seasonal variation in temperate waters, and the sensitivity of organisms to poisons liberated from anti-fouling compositions are discussed. The effects of toxins are outlined and methods of evaluating anti-fouling paints are surveyed. The physical properties of anti-fouling paints are just as important as the chemical characteristics associated with toxicity. Excellent anti-fouling protection has resulted from the use of paints containing sulphides of different solubilities; cadmium sulphide must be one of them.

Recent research on corrosion and protective coatings is reviewed, and covers the use of: vitreous-enamel types of paints, cement–concrete, cement–asbestos, rubber–wax sheathings, hot tar, and hot bituminous applications.

Other materials described are the use of asphalt ("Lithocrete") for deck covering, coloured asphalt coatings for interior paintings of ships, "Acetas," an acid-resisting asphalt, for flooring, cattle spaces, and tank interiors, "Oilphalt" for tank tops and decking spaces, "Gunphalt" for flame spraying, plastics for spraying, "Tieoil" (Bitulac Co.), largely used for covering hot pipes, and also for interior work on ships.

Notes on the Admiralty Corrosion Committee tests give details of a zinc-chromate primer and an associated second (anti-fouling) coating for protecting aluminium alloys in sea-water. An effective "wash primer" is described which contains polyvinyl-butyral resin, insoluble zinc chromate, and phosphoric acid. The article is to be continued. W. H. C.

1490. **Pressure Drops —300° F.** W. L. Nelson. *Oil Gas J.*, 12.8.48, **47** (15), 115.—No. 209 in the Refiner's Notebook series gives a chart showing pressure drop per 100 ft equivalent length—p.s.i. against gal/min and b.d. at 60° F, for gasoline, kerosine, gas oil, light and medium lubricating oil of stated viscosities.

Multipliers for surface condition and for Schedules 80 and 160 pipes are given.

G. A. C.

BOOKS RECEIVED.

Review of Middle East Oil. London : Petroleum Times Ltd., 1948. Pp. 115. 7*s.* 6*d.*

In the autumn of 1947 Dr C. T. Barber, joint editor of *Petroleum Times* made an extensive tour of the Middle East oilfields, during which he studied technical, economic, and sociological aspects of oil developments in the area. Thus, this book provides up-to-date information on Middle East oil. Following an introductory chapter on the economics of the subject, each area (Iran, Iraq, Bahrein, Saudi Arabia, Haifa refinery, Kuwait) is discussed in turn.

Four special articles are also included : "*The Oilfield Province of the Middle East*," by G. M. Lees, chief geologist to Anglo-Iranian Oil Co. Ltd., "*Political Problems and Policies*," by Max Weston Thomberg, "*The Middle East : A Depressed Area*," by Christopher Holme, and "*Aerial Surveying in the Middle East*," by T. D. Weatherhead.

German Intelligence Reports.

B.I.O.S.

1772. Some Engineering Aspects of the Edeleanu Process. Pp. 46.
1781. Production of Monomeric Styrene at Chemische Werke, Huls. Pp. 348.
1783. German Practice in the Production and Utilization of High Boiling Coal Tar Chemicals. Pp. 45.

ABSTRACTS.

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Oilfield Exploration and Exploitation.

Geology.

1491. Transformation of Organic Substances by Alpha Particles and Deuterons (*Symposium on Radiation Chemistry and Photochemistry, University of Notre Dame, Notre Dame, Indiana*, June 24–27, 1947.) I. A. Breger. *J. Phys. & Colloid Chem.*, 1948, **52**, 551–563.—The work reported is concerned with the possible role of radioactivity in petroleum genesis. Although high pressures and temperatures have long been considered important sources of energy for the formation of petroleum in Nature, evidence has been previously presented which indicates that temps above 250–300° C are precluded. It has been suggested that petroleum may have been formed by decomposition and conversion of the solid and semi-solid organic compounds in marine sediments by radiations from the radioactive constituents of sedimentary rocks.

The work described shows that fatty acids can be radiochemically converted into the aliphatic components of crude oil, and that naphthenic acids can be converted into the alicyclic components. Long-chain alcohols, amines, and acids have been irradiated, and it has been shown that deamination and decarboxylation are relatively easy, but that dehydroxylation is very difficult. A serious objection to the radioactivity theory is the fact that whereas hydrogen is a major gaseous reaction product of all the reactions carried out except one, natural gas contains only traces of hydrogen. However, the bombardment of oleic acid to produce 3% stearic acid indicates that hydrogenation occurs as a result of irradiation.

Thirty-nine references are given. D. F. J.

1492. Discovery of Oil Structures by Aerial Photography. B. M. Bench. *Oil Gas J.*, 26.8.48, **47** (17), 98.—An account is given of the use of aerial photography in geological mapping. Special attention is given to geological interpretation of the photographs. The features of significance are noted, together with their geological causes. G. D. H.

1493. Summary of Middle Ordovician Bordering Allegheny Synclinorium. M. Kay. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1397–1416.—The Middle Ordovician in this area is divided into the Chazyan, Bolarian, and Trentonian series. The Chazyan Blackford and Five Oaks formations probably underlie much of the synclinorium; the Lincolnshire is limited to the southeastern border. The Bolarian Hatterian subseries is also extensive.

The lower Trentonian has belts of differing facies in the south, and thins to the southeast. The middle Trentonian is limestone beneath and along the eastern margin, while the stratigraphy of the upper Trentonian has been studied only in the northeast. E. N. T.

1494. California Gets Most Important Strike in Years. Anon. *Oil Gas J.*, 1.7.48, **47** (9), 103.—Two wells recently completed in the Cuyama Valley of Santa Barbara and San Luis Obispo counties have aroused great interest. A-28-5 Russell gave 500 b.d. of light oil and 2 Anderson–Colgrove, 2½ miles to the northwest, flowed 4000 b.d. The first well had 250 ft of oil-saturated sand in the interval 2970–3360 ft.

Some believe that both wells produce from the Temblor. A-28-5 Russell is considered to be on a long narrow anticline against a thrust; 2 Anderson–Colgrove may be a stratigraphic trap. The valley is part of a 300-mile-long trough some 20 miles wide. The larger anticlines have been deeply eroded. G. D. H.

1495. Richfield Opens Cuyama Valley for New California Field. H. David. *Oil Gas J.*, 5.8.48, **47** (14), 51.—Richfield 28-5 Russell-A flowed 38·3° oil at 500 b.d. from 250 ft of oil sand at 2970–3360 ft. Five days later 37-30 Anderson–Colgrove, 2½ miles to the northwest, came in with 4000 b.d. of 33° oil at 3019 ft. An offset in the latter area has given 3912 b.d. In each case production is from the Vaqueros which first produced at Elwood some 30 miles to the south in 1928, but there are thought to be two fields. 28-5 Russell-A is considered to be on a long, narrow anticline against a thrust fault. 37-30 Anderson–Colgrove may be a stratigraphic trap. The Cuyama Valley is a sedimentary basin 50 miles long and 15 miles wide, midway between the San Joaquin Valley and the coastal region. It is part of a graben some 300 miles long which developed during Upper Oligocene and Miocene. Post-Miocene deposits are thin and non-marine. The large anticlines have been deeply eroded.

Drilling conditions are ideal, and light portable power rigs are employed.

G. D. H.

1496. California's New Field May be Best of a Decade. Anon. *World Petrol.*, Aug. 1948, **19** (9), 36.—The Colgrove and Russell leases in the Cuyama Valley district of California are 2 miles apart, and both produce from the Vaqueros. The sands have the same permeability and similar gas–oil ratios. The valley is a deep sedimentary basin 50 miles long and 15 miles wide, and has seepages. The first well was small and gave 20° oil. The discovery well gave 38° oil at 508 b.d. from 3360 ft.

Colgrove No. 2 flowed 4080 b.d. and 1,500,000 cu. ft. of gas. The gas–oil ratios are low, and it is thought that water-drive may be operative.

A map and cross-section of the Caliente range and Cuyama Valley are appended.

G. D. H.

1497. Oil Possibilities in Florida. L. S. McCaslin. *Oil Gas J.*, 1.7.48, **47** (9), 64.—About 70% of Florida is under lease, and 104 wells have been drilled since 1940. The first well was drilled in 1900. The Sunniland field was opened in 1943, producing 97 b.d. of 20·8° A.P.I. oil, from 11,613–11,626 ft. The field now has six wells and has produced 407,500 brl of crude.

A well 3 miles north of Cedar Keys, in Levy County stopped in Palæozoic beds at 5860 ft. A second well is drilling at 9100 ft, and met Eagleford at about 7100 ft. High-velocity beds near the surface have hindered seismic work.

The Appalachicola embayment of South Georgia and West Florida has a maximum of over 15,000 ft of clastic sediments, while the South Florida Embayment, which stretches to Cuba, has a maximum of 20,000 ft of non-clastics, the Great Bahama Bank having over 10,000 ft. Folding and some faulting may be present in both embayments. The shallow formations present many difficulties due to honeycombing and water flows.

G. D. H.

1498. Gulf Coast Structural Problems. Anon. *Oil Gas J.*, 24.6.48, **47** (8), 257.—The principles upon which the Schlumberger dip meter is based are described, and its application in Gulf Coast drilling operations is noted. Dip data may indicate the direction of deflection which may convert a dry hole into a producer, especially in testing salt-dome structures. Examples of the application of the dip meter are described, including a case where drag near a fault was revealed.

G. D. H.

1499. Basic Geology of the Gulf Coastal Area and the Continental Shelf. J. B. Carsey. *Oil Gas J.*, 24.6.48, **47** (8), 160.—On the Gulf Coast plain, which is up to 100 miles wide, Quaternary to Tertiary beds outcrop in going inland. The Tertiary beds grade down-dip from continental sands and shales to marine sands and shales, with a diminution of sand to the south. About 190 salt domes are known; others are probable. They are the main oil structures.

The continental shelf continues the land slope out to about 100 fathoms; and there the slope increases. The Gulf Coast shelf covers about 132,000 sq. miles. The Atlantic coast shelf is 127,000 sq. miles. Some 140 topographic features are known on the shelf off Texas and Louisiana. Gravity surveys over some show them to be minima, and therefore presumably salt domes. Detailed delineation of these domes is usually done by seismograph. The Texas coast should be favourable for oil around domes in the Miocene, and the same should be true of the shelf just off southwest Louisiana. Salt-dome production has been obtained on the Mississippi delta. In 1938 the Creole

field was opened in 9 ft of water, 1 mile off Cameron Parish. In 1947 a salt-dome field was discovered 11 miles off-shore in 17 ft of water.

Off Louisiana 2,117,582 acres has been leased, and 278,198 acres dropped. In November 1947 Texas sold leases covering 379,595 acres. Inland from the Gulf Coast it appears that there is an average of one structure to 100 sq. miles. It is not known whether this density holds off-shore. Each land structure may average 20 million brl. Should similar conditions hold on the shelf 4000–5000 million brl might be expected in the 31·4-mile off-shore belt, but much would not be accessible by present-day techniques. Exploration in water up to 100 ft deep may be possible. A platform for drilling may cost over $1 million before drilling begins, and a 14,000-ft well would cost a further $500,000. G. D. H.

1500. Operations under Way at 21 Locations along Continental Shelf. N. Williams. *Oil Gas J.*, 24.6.48, **47** (8), 152.—A brief account is given of the extent and history of off-shore leases in the Gulf of Mexico. In the Creole field, 1½ miles off-shore, the ten wells were drilled from one platform. Other wells have found salt domes, and in two cases oil production has been established. A gas field has been opened. Notes are given on these discoveries. G. D. H.

1501. Developments in Illinois and Indiana in 1947. E. H. Bell and R. E. Esarey. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 920–930.—2727 wells were drilled for oil and gas in this area in 1947 as compared with 2870 in 1946. Total oil production increased from 82,128,000 brl in 1946 to 82,900,000 brl in 1947; wildcat drillings increased from 760 to 792. Forty-four new pools and seventy-six extensions were discovered.

The new production was almost wholly from Mississippian strata. Little deep drilling was done, and no major production came from strata below the Mississippian. A "Trenton" pool was discovered at Woburn South in Bond County, which had six producing wells by the end of 1947. E. N. T.

1502. New Viola Pool for Barber County, Kansas. Anon. *Oil Gas J.*, 3.6.48, **47** (5), 121.—The De Geer field of Barber County, Kansas, was opened by a well producing from the Viola at 5176–5178 ft. 41° oil was produced at 29 brl/hr on a ¼-in choke.

The well met the Mississippian at −2910 ft, the Viola at −3200 ft and the Arbuckle at −3435 ft. The nearest Viola production is at Deerhead, 1½ miles to the north. G. D. H.

1503. Developments in Kentucky in 1947. E. B. Wood. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 913–917.—Most of the new oil and gas discoveries in Kentucky in 1947 were in West Kentucky from horizons ranging from Pennsylvanian to Devonian.

East Kentucky development was in Pennsylvanian to Lower Ordovician, and discoveries included wells in the St. Peter sandstone and Knox dolomite.

In South-central Kentucky the Seventy-Six pool in the Ordovician of Clinton County was developed.

The total estimated oil production for 1947 was more than 9,500,000 brl. E. N. T.

1504. Trenton and Pre-Trenton of Kentucky. A. C. McFarlan and W. H. White. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1627–1646.—In Kentucky, outcropping rocks range as low as the Stones River and include the High Bridge, Lexington, and Cynthiana beds. Their general character, significant fossils, and stratigraphic relationships are outlined. Two wells have penetrated the Cambrian, one probably the pre-Cambrian. Contributions by several workers have modified hitherto accepted correlations, and these results are listed. E. N. T.

1505. Another Offshore Field in Gulf? Anon. *Oil Gas J.*, 17.6.48, **47** (7), 123.—A well off Terrebonne Parish, Louisiana, flowed oil, and later mud and water with a little oil and gas from 6885 to 6888 ft. After drilling to 9355 ft, 1090 ft below the top of the salt, seismic work was carried out to outline the salt mass. Gas had been found at 7320–7322 ft, 7268–7273 ft, and 6999·5–7001·5 ft. Radioactive logging has indicated an oil sand at 6455–6500 ft.

The salt dome was defined by refraction shooting.

It is believed that two of the gas sands would have been of commercial value if on and near a market. G. D. H.

1506. Two more Offshore Hits. Anon. *Oil Gas J.*, 22.7.48, **47** (12), 131.—10 miles off-shore from Vermilion Parish, Louisiana, a second oil producer has been drilled. The pay at 2804–2824 ft gave 647 b.d. on test. This well was directionally drilled from the same platform as the discovery.

19 miles off-shore from Vermilion Parish Superior's 13,628-ft well has been perforated at 9608–9618 ft, and gave 65 b.d. of 52° condensate with 7,024,000 cu. ft. of gas. G. D. H.

1507. Louisiana Offshore Area Gets Two More Discoveries. Anon. *Oil Gas J.*, 19.8.48, **47** (16), 153.—7 miles off-shore from Grand Isle, Jefferson Parish, a well is reported flowing 800 b.d. of 30·9° oil from 8640 to 8665 ft. Salt was met at 7607 ft in the original hole and a side-track directional hole was started at 3900 ft. A second well, east of the Mississippi delta and south of Breton Sound, has had numerous oil shows between 3700 ft and 6700 ft. G. D. H.

1508. Cambrian and Ordovician Rocks in Michigan Basin and Adjoining Areas. G. V. Cohee. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1417–1448.—Upper Cambrian and Ordovician sandstone, limestone, and dolomite are exposed or underlie glacial drift in the Northern Peninsula of Michigan. Middle Ordovician rocks overlap progressively older rocks eastwards across the Peninsula. This stratigraphic relationship is observed in other outcrop areas in Ontario and in deep wells that have penetrated the full section of sedimentary rocks.

Cambrian and Lower Ordovician ("Sub-Trenton") sandstone and dolomite range in thickness from less than 500 ft to more than 3500 ft in Michigan. The aggregate thickness of these rocks increases southwestward from Michigan towards Illinois, and thins southeastward over the Findlay arch in southeastern Michigan and northwestern Ohio.

The widespread limestones and dolomites of Middle Ordovician age rest on eroded Lower Ordovician and upper Cambrian rocks in Michigan, northern Indiana, and northwestern Ohio, and range in thickness from less than 200 ft in the Northern Peninsula to more than 900 ft in southeastern Michigan.

Oil and gas were commercially produced from the "sub-Trenton" rocks in Ohio on the east flank of the Findlay arch in several small areas.

The Trenton limestone, which is the producing formation in the Lima–Indiana field, is productive in small areas in southeastern Michigan and southwestern Ontario.

E. N. T.

1509. S.E. New Mexico Gets First Pennsylvanian Production. Anon. *Oil Gas J.*, 26.8.48, **47** (17), 181.—A well on the southwest side of the shallow Eunice field has flowed 40° oil from a Pennsylvanian sand at 10,900–10,949 ft in a drillstem test. Eunice produces mainly from the Permian Grayburg pay at 3800–4000 ft. The proved area is about 40,000 acres.

There have been three other Pennsylvanian strikes on the Central Basin platform, but none of them has so far proved to be substantial. These were in the White and Baker field of Pecos county, the Block 39 field of Crockett county, and in the Addis field of Ector county, Texas. G. D. H.

1510. San Juan Basin. F. G. Barnes. *Oil Gas J.*, 27.5.48, **47** (4), 73.—The San Juan basin of New Mexico and Colorado covers about 12,000 sq. miles. Oil was discovered in 1911 in the Seven Lakes area.

The outcrops range from pre-Cambrian granite and schist to Tertiary sediments. Commercial oil production has been obtained from the Pennsylvanian and Upper Cretaceous. Strong gas shows have been found in Mississippian–Devonian limestones, and oil shows in the Jurassic. The principal production is from folds. Ten out of seventeen fields or areas are anticlinal; the remainder are predominantly stratigraphic traps. About eighty structures are known, and thirteen are now productive. About twenty-five have never been tested, and many of those drilled have not tested all reasonable possibilities.

The Pennsylvanian has produced a little oil and gas, and is believed to have good prospects. In places, the Pennsylvanian is absent, and where it thins there is a chance of stratigraphic traps. The Dakota has produced only from anticlines. The Mancos shale has oil shows. Some oil and gas have been produced from the Mesaverde group

on folds and in stratigraphic traps. The Pictured Cliffs sandstone has yielded gas, and the lenticular Farmington sandstone gives a little oil and gas.

A table lists the oil and gas fields of the San Juan basin, with discovery year, structure, size, depth, and pay thickness. There is also a generalized stratigraphic column.
G. D. H.

1511. Developments in New York in 1947. E. R. McAuslan. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 893–896.—By the end of 1947, twenty-seven wells were completed or drilling in the Oriskany gas sand. Total gas produced amounted to 2,388,312 million cu. ft.

In the oilfields there were 1700 completions, but only a few of these were wildcats, which all failed to find oil in commercial quantity. The average daily production decreased from 12,828 brl in 1946 to 12,349 brl in 1947. E. N. T.

1512. New York Subsurface Geology. E. T. Heck. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1449–1456.—This paper summarizes the data available on the Trenton and sub-Trenton formations as shown in wells in New York State. About twenty wells have been reported to have reached the basement complex, most of which have been located near to Great Lakes or the Adirondack pre-Cambrian area. A cross-section and contour maps are given. E. N. T.

1513. Trenton and Sub-Trenton of Outcrop Areas in New York, Pennsylvania, and Maryland. F. M. Swartz. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1593–1595.—In this very comprehensive paper, the outcropping Trenton and sub-Trenton rocks in New York, Pennsylvania, and Maryland are described and their conditions of origin and palæogeography are discussed. The basement rocks are also considered. Stratigraphic charts and isopachous and palæogeographic maps are presented for the Glenarm, the Lower Cambrian, the Middle and Upper Cambrian, the Lower Ordovician, and the Middle Ordovician sediments of the region. Consideration is given to the relationship of the Trenton and sub-Trenton outcrops in New York, Pennsylvania, and Maryland, with respect to the search for oil and gas. E. N. T.

1514. Subsurface Trenton and Sub-Trenton Rocks in Ohio, New York, Pennsylvania, and West Virginia. C. R. Fettke. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1457–1492.—The salient features that have been revealed by drilling into Trenton and sub-Trenton strata in the northern part of the Appalachian basin are presented and discussed.

Maps are given showing the regional structure on the top of the Trenton limestone and the thicknesses of the Middle and Upper Ordovician series in the northern part of the basin. The lithological characteristics of the Trenton and sub-Trenton formations are illustrated by well-sample records.

Data are presented indicating that the dolomitic sandstones and sandy dolomites underlying the pre-Black River unconformity, heretofore correlated with the St Peter sandstone, do not represent a single horizon, but become progressively younger in a southerly direction in Central Ohio.

Possibilities of the Trenton and sub-Trenton formations as potential sources of oil and gas are discussed. E. N. T.

1515. Developments in Oklahoma in 1947. D. C. Wellman. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 948–959.—There was much successful wildcatting in Oklahoma in 1947, especially in the southeastern Anadarko basin area. Additional accumulations of oil were discovered notably in Pennsylvanian, Hunton, and Simpson formations.

Oil production increased to 141,445,630 brl, 3·3% more than in 1946. Oil reserves increased by 6·1%. Production of marketed natural gas increased to 404,843,389,000 cu. ft, 7·1% above the 1946 total. Total reserves of natural gas increased by 5·7%.

The deepest well in the world was completed at a depth of 17,823 ft. In Oklahoma 3977 wells were drilled, of which 904 were wildcats resulting in 147 new discoveries.
E. N. T.

1516. Geologic Aspects of Petroleum Exploration in Pennsylvania. F. M. Swartz, *Producers' Monthly*, Jan. 1948, **12** (3), 21 (*Paper presented at 11th Annual Secondary Recovery Conference, Pennsylvania State College*, Oct.–Nov. 1947).—Petroleum exploration in Pennsylvania is discussed under the following headings: (1) surface structure in area of the Phillipsburg Magnetometer Survey and relation to geophysical

data; (2) geologic usefulness of aerial photographs in W. Pennsylvania; (3) structure and convergence in selected gas fields in New York and Pennsylvania; and (4) stratigraphy, convergence, and palæogeography of Trenton and sub-Trenton in outcrop areas in Pennsylvania, Maryland, and New York. Eight references are appended.
R. B. S.

1517. Petrologic Aspects of Prospecting for Deep Oil Horizons in Pennsylvania. P. D. Krynine. *Producers' Monthly*, Jan. 1948, **12** (3), 28 (*Paper presented at 11th Annual Secondary Recovery Conference, Pennsylvania State College*, Oct.–Nov. 1947).—The origin of oil reservoirs and the characteristics of producing sands are discussed: specific problems in the Appalachian region are outlined. R. B. S.

1518. Developments in Rocky Mountain Region in 1947. H. C. Rea. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 886–892.—Sixteen new discoveries were made in the Rocky Mountain area in 1947—six by surface geology, seven by geophysics, and three by a combination of geophysics and geology.

Commercial production of oil from the Pennsylvanian Casper formation at Herrick Dome opened up a hitherto-doubtful producing zone; and oil production from the Kibbey sand (Upper Mississippian) in Montana, can be classed as a new producing zone. A previously unknown reserve discovered was the Madison Limestone (Mississippian) in the Lost Soldier field in Wyoming.

Twenty-five successful outpost wells and five successful deep-pool tests were completed. 160 million brl of oil were added to the proved reserves.

Shallow sand traps were successfully developed along the northeast rim of the Powder River Basin and suggest similar possibilities in other Rocky Mountain regions.

Exploration activity was the highest on record, eighty seismographic and forty-six gravity parties operating at the same time, mainly in the Wyoming basin area. Over 110,000 sq. miles were photogeologized, and many previously unmapped structures discovered. E. N. T.

1519. Waters of Producing Fields in the Rocky Mountain Region. J. G. Crawford. *Petrol. Tech.*, May 1948, **11** (3), *A.I.M.M.E. Tech. Pub. No.* 2383, 1–23.—Typical analyses of waters from different sands in various Rocky Mountain oilfields are presented. In some cases the characteristics indicate little change since deposition, but in others there are signs of extensive modification, pointing to active ground-water circulation. Generally the waters have been influenced by the petrography of the enclosing rocks. Hydrogen sulphide is usually present in pre-Triassic beds; its occurrence in Jurassic and Lower Cretaceous waters is usually in association with limestone or sulphate-bearing water, suggesting hydrogen-sulphide formation by bacterial action.

Water analyses have proved of value in the identification of the origin of intrusive waters in wells. There seems to be no relationship between the presence or absence of commercial oil and the nature of the water in a structure. Commercial oil and gas fields in the Rocky Mountain area have saline and alkaline, dilute and concentrated, and fresh and stagnant waters. G. D. H.

1520. Developments in East Texas in 1947. H. H. Lester. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1009–1023.—Field well completions in this area in 1947 totalled 557, 6% below the 1946 figure, with completed wildcats accounting for 101 wells.

Five new oilfields and three gas or gas-distillate fields were discovered. Five discoveries were completed in the Glen Rose, one each in the Eagle Ford, Woodbine, and Travis Peak formations. None are major discoveries, but the Blackfoot (Pettit) discovery in Anderson County may prove important.

New producing zones were discovered at Carthage, Chapel Hill, Grapeland, Hawkins, Lassiterm Quitman, Sand Flat, and Tri-Cities. Jurassic tests at Quitman, Hawkins, Coke, and Firfield failed to disclose the downdip extent of Smackover porosity.

Geophysical exploration declined 34% from 1946. An average of thirteen reflection seismograph crews, two gravity crews, and two core-drill units was maintained through 1947. E. N. T.

1521. Developments in Upper Gulf Coast of Texas in 1947. P. H. Clark. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1024–1031.—874 new wells were drilled in this region, a 28·3% increase over 1946.

Wildcats resulted in twenty-one new discoveries as compared with fifteen in 1946. All the new discoveries are of minor importance, including ten oilfields, eight gas-condensate fields, and three dry-gas fields.

Six to ten times as much oil and twice as much gas came from extensions in old oilfields than from all the new fields. Field development was up 26·5% over 1946 and was more successful than last year. Fifty-one important developments took place in old fields, including twenty-nine new sands, fifteen new reservoirs, and seven extensions.

Geophysical work was used increasingly, and subsurface work was also important.

The first Woodbine sand production for the district was obtained from a small gas well in the Glendale field.

1947 oil production totalled 191,166,000 brl, an increase of 6% over 1946.

E. N. T.

1522. Developments in North and West-Central Texas in 1947. J. H. Stovall, L. W. Dorbandt, and W. L. Ammon. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 988–996.—There were 144 discoveries in 1947 in this area, including fifty wildcats, thirty-nine new-pool wildcats, twenty-five extensions, twenty-four deeper-pool tests, and six shallower pay tests. There were 102 discoveries in 1946.

2979 wells were drilled, 835 of them exploratory, compared with the 1946 figures of 3007 and 653 respectively.

A total of 62,127,309 brl of oil were produced in 1947, an increase of 4,287,399 brl over 1946.

The 144 discoveries and extensions were as follows: two from the Permian, twenty-five from the Cisco, eight from the Canyon, sixty-nine from the Strawn, sixteen from the Bend, thirteen from the Mississippian, and eleven from the Ordovician.

Subsurface and seismograph continue to be the most successful exploratory methods.

E. N. T.

1523. Developments in Texas Panhandle in 1947. L. B. Fugitt and R. C. Morris. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 960–962.—In 1947 429 wells were completed in the Texas Panhandle area, 240 being oil wells, 178 gas wells, and twenty-two dry holes.

No new fields were discovered, but a well in Hansford County was temporarily abandoned after giving a promising oil show from a Pennsylvanian granite wash zone.

In 1947 the Panhandle field produced 2·98 million brl of oil, roughly the same as the 1946 production. Gas production was 834·76 billion cu. ft.

The areas of intense leasing were Castro County in the southwest and Wheeler, Hemphill, Roberts, and Lipscomb counties in the northeast part of the district. Geophysical operations were concentrated in these areas, and there was an increase in seismic and core-drill operations.

E. N. T.

1524. Developments in West Texas and Southeastern New Mexico in 1947. C. D. Cantrell, L. C. Mills, and C. W. Turner. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 963–983. 2854 wells were drilled in this area in 1947, a 28·6% increase over 1946. There were 384 exploratory wells, 117 being oil wells and six gas wells, a success percentage of 32·0%. Thirty-six new fields and twenty-five new pools were discovered.

Fourteen important discoveries were made by deeper drilling on known Permian structures, and by seismograph and subsurface geology. Intensive geophysical activity is being carried out, the seismograph predominating, and core-drilling continues in many areas.

E. N. T.

1525. Benedum Prospects in West Texas not too Promising. Anon. *Oil Gas J.*, 12.8.48, **47** (15), 135.—A well 3 miles west and a little north of the Benedum discovery was dry and 480 ft lower. A well 3 miles north and slightly west of the discovery is 600 ft lower and probably dry, although the upper pays have not been fully tested. A well to the northeast is running 500 ft low at the top of the Silurian. The one successful well is ¼ mile northwest of the discovery, and in a drillstem test gave 15–25 brl of 51° oil per hour, with a gas flow estimated at 10–15 million cu. ft/day.

Benedum seems to be a local high on a regional high in the Midland basin.

G. D. H.

1526. Utah May Get New Oil Field. Anon. *Oil Gas J.*, 15.7.48, **47**, (11), 133.—Carter Oil Co 1 Nelson in Uintah County topped the Wasatch at 7070 ft, cored 4½ ft of gas sand and 2 ft of oil sand, and a drillstem test at 7068–7079 ft flowed gas at 5,600,000 cu. ft/day and recovered 30 ft of oil. A second test at 7079–7089 ft had gas at 3,700,000 cu. ft/day with a spray of oil in addition to 156 ft of oil in the pipe. The test is said to be based on structure.

The Rocky Mountain area has no major Tertiary production, but oil and gas occur in commercial quantities in the Wasatch at LaBarge, Big Piney, Hiawatha, and Powder Wash. The Wasatch is continental at the last two points. G. D. H.

1527. Developments in Virginia in 1947. P. Jenkins. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 912.—Faulted structural conditions limit the prospective oil and gas areas of Virginia. Gas was first commercially produced in the Early Grove field in 1938, and oil near Rose Hill in 1944. Since the discovery, thirty wells have been drilled, of which fifteen were producing 400 b.d. by the end of 1946. Production is now greatly decreased owing to mechanical difficulties.

Three new wells were being drilled at the end of 1947. One has since come in at a depth of 2301 ft, producing 17,000 million cu. ft. of gas from the Maxon sand.

E. N. T.

1528. Current Drilling Evokes Interest in Virginia's only Producing Oil Field. P. Jenkins. *Oil Gas J.*, 19.8.48, **47** (16), 72.—Seepages led to the first drilling in the Rose Hill area of Lee County, Virginia. A thrust sheet is at the surface, but in places the underlying beds have been exposed. Early drilling had some shows and in 1942 a 60-brl well was completed. A table summarizes the results of forty-four wells drilled in the Rose Hill area, and a second table gives some production data. Brief notes are given on the drilling. G. D. H.

1529. Trenton and Sub-Trenton Stratigraphy of Northwest Belts of Virginia and Tennessee. C. E. Prouty. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1596–1626.—The Lower Cambrian is the oldest formation exposed in the northwest of Virginia and Tennessee, being represented by the thick clastics of the Rome series. The overlying Conasauga group consists chiefly of shale in northwest Tennessee, and grades through shales and limestones into dolomitic limestones and dolomite to the southeast and east. The Copper Ridge (Upper Cambrian) and Beekmantown (Lower Ordovician) dolomites grade southeastward into limestones. The barrier of the Tazewell arch is similar to, and probably an extension of, the Adirondack arch on the northeast, and possibly partly coincides with the Rome barrier of Ulrich.

Middle Ordovician rocks southeast of the Tazewell arch are thick and highly clastic. The arch was particularly effective in separating typically geosynclinal rocks from the foreland rocks on the northwest, being more effective in Tennessee than in Virginia.

Recent oil developments in the area of the Cumberland thrust block in Lee County, Virginia, have created additional interest in the northwest outcrop belts. Oil has been produced from the Trenton, Eggleston, and "Lowville" limestones, with a showing from the Beekmantown dolomite. Field indications suggest that reservoir-rock porosity depends on fracturing. E. N. T.

1530. Report on New Gas Developments in Southern West Virginia. E. H. Tollefson, W. H. Mayfield, and A. R. McCamey. *Oil Gas J.*, 5.8.48, **47** (14), 82.—Eight gas fields have been found in southern West Virginia. Production is mainly from the Mississippian, but there are Pennsylvanian and Devonian shows. The gas occurs shallower than 4000 ft, and averages 97% methane and 2% ethane, with an almost complete absence of oil and gasoline.

The first gas development was in 1919, but not until 1944 was there much development. There is a developed reserve of 95,000 million cu. ft. To date withdrawals are about 37,000 million cu. ft.

The average drilling rate for seventy-nine wells was only 24·2 ft/day, due to the hard formations. In the Berea, shooting has been beneficial.

The Ravencliff sandstone is variable, and production is erratic. Trapping is by lenticularity. The Maxon sandstone also has lenticular accumulations. In the Greenbrier are dolomitic and oolitic zones, and most wells have found some gas. This is the only formation with wet gas. The Berea is the most productive horizon. It thins

to the east and south and probably changes from sandstone to siltstone, thus leading to trapping.

Generally accumulation in the Mauch Chunk and Greenbrier is due to stratigraphic conditions, but there are three main folds which act as secondary controls.

G. D. H.

1531. Wyoming Well Sets World Production Depth Record. Anon. *Oil Gas J.*, 20.5.48, **47** (3), 131.—A well in the West Poison Spider field, Wyoming, flowed 44° oil at 34 brl/hr in a drillstem test of the Frontier sand. The total depth was 14,211 ft, with casing set at 13,791 ft. G. D. H.

1532. Wyoming's Powder River Basin in Red-hot Play. Anon. *Oil Gas J.*, 8.7.48, **47** (10), 119.—1 Christensen–Davis in Weston County recovered oil from the Dakota, topped at 6712 ft, in a test at 6730–6738 ft. Oil saturation had been noted in the Muddy at 6494–6502 ft.

10 miles northeast 1 Kummerle recovered oil and water in tests at 5400 ft, 24 ft below the top of the Dakota.

A little north of Salt Creek, 1 Cowles in Johnson county recovered oil from the Dakota at 7693–7726 ft. G. D. H.

1533. Five-year Extension of Arctic Alaska Oil Search now Appears Certain. Anon. *Oil Gas J.*, 17.6.48, **47** (7), 44.—It seems certain that full-scale oil search in U.S. Navy Petroleum Reserve No. 4 in Alaska will be extended for five years. The two tests at Umiat are not considered to justify additional drilling now in that area. Both were dry holes, although one found a little high-gravity oil at 350 ft, and they are considered to show that the lower part of the Lower Cretaceous–Jurassic sequence does not hold much promise of reservoir rocks. The sands are clayey.

The Simpson well, drilled near seepages, was taken to 7200 ft. The Tertiary was 2800 ft thick, and the Cretaceous about 3300 ft thick. Beneath was a limestone with probable Mississippian limestone pebbles. Then followed 400 ft of Jurassic and Triassic which rested on somewhat metamorphosed shales. The oil seepages are believed to originate in the Tertiary.

A 6000-ft test is to be drilled near Point Barrow, and geological and geophysical work are to continue. G. D. H.

1534. Developments in Canada in 1947. J. G. Gray and E. L. Fournier. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1079–1092.—The discovery of a major oilfield at Leduc, Alberta, in February 1947 resulted in greatly accelerated drilling and exploration. The total footage drilled in Alberta was 883,938 ft, resulting in 102 completed oil wells, fourteen incomplete but probable oil wells, thirty-three gas wells, seventy-five dry holes, and one salt well. Besides the Leduc find an important discovery was made in the Lower Cretaceous strata at Bantry. Total oil production for the province amounted to 6,382,052 brl of crude and 427,225 brl of natural gasoline.

Active exploration for gas was continued in Southern Alberta, and important new gas discoveries were made. Seismic exploration was the most popular exploration method, though others were used extensively. Most of the exploration efforts were directed at finding additional Devonian pools in the low-dip strata of the Plains region. Less attention was paid to the foothills region than in previous years. Several deep tests were made, and wet gas was discovered in the southwestern corner of the province, in the Pinchin Creek area.

In Saskatchewan an extremely active drilling programme was conducted in the Lloydminster–Lonerock area where shallow Lower Cretaceous production was being developed. There were 105 wells drilled, with a total footage of 204,485 ft. Of these, eighty-nine were development wells and ten exploration wells. Two wildcats were being drilled elsewhere in the Province. The total oil production for the year was 535,033 brl, all from the Lloydminster–Lonerock field.

No deep drilling was undertaken in British Columbia. One well was suspended at a depth of 2303 ft in the Lower Mainland area.

Manitoban oil- and gas-producing possibilities aroused interest. About 750,000 acres of Crown lands situated in the southwestern part of the Province were reserved and leased during the year, and extensive seismic and geological surface studies were

made. Two wells were drilled for oil and gas, one of which was abandoned at the top of the pre-Cambrian at 2519 ft, while the other was suspended at 1540 ft.

Activities in the northwest were confined largely to the production of oil from Norman Wells. Total production for the year was 297,256 brl. Two diamond-drill holes were drilled on the Hay River to depths of 918 and 351 ft respectively.

The decline in Western Canadian crude production was halted. As a result of the Leduc and Woodbend developments the present production rate should be doubled in a year. The Lloydminster field greatly expanded production. New refinery capacity was set up at Lloydminster and at Edmonton.

Exploratory drilling in Eastern Canada was concentrated mainly in Southwest Ontario, where the search for gas reserves accounted for 70% of the wells. A new gas field was discovered at Kimball in the Salina formation.

An important test was drilled in the Minudie anticline in Nova Scotia. The well was abandoned as a dry hole in Mississippian rocks at 11,504 ft. E. N. T.

1535. Pemex Claims Discovery of Oil near Rio Grande. Anon. *Oil Gas J.*, 12.8.48, **47** (15), 47.—Two wells 5 miles south of Reynosa have found two Cretaceous pay zones. One pay at 4470 ft tested 60° oil and the other at 6640 ft tested 50° A.P.I. oil. Between the oil zones are three gas horizons. G. D. H.

1536. Puerto Rican Geophysical Survey Shows Favourable Possibilities. Anon. *Oil Gas J.*, 1.7.48, **47** (9), 37.—A geophysical survey of the northern and southern coastal plains of Puerto Rica has been in progress for two years and is nearly complete. No oil or gas seeps have been found, but a maximum sedimentary section of 6000 ft is indicated. In addition to tidelands, surveying has also extended 7 miles off-shore.

The mountainous core of the island has Upper Cretaceous considered to have negligible oil possibilities. The unconformable Tertiary is viewed more favourably, and this occurs in two basins represented by the north and south coastal plains. An anticlinal nose has been detected in the latter area. G. D. H.

1537. International Developments. Anon. *Oil Gas J.*, 26.8.48, **47** (17), 85.—A well on Colon island off Bocas del Toro, Panama, has reached about 8000 ft.

A second test is being drilled on the San Andres concession in Colombia. The first well was abandoned at about 6900 ft.

The Mulata field, Venezuela, covering 32,000 acres, produces 24,000 b.d. from over 200 wells. Roble, with some 36,500 acres, has seventeen wells producing 6000 b.d. A deep well, Roble 15, was taken to 11,850 ft to test the Merecure formation. Cores showed highly porous, saturated sands. The well is now being tested.

In the Tucupido concession are five producers giving 3300 b.d. of 40° oil. The Pelayo concession has two wells capable of giving about 1000 b.d. Socororo 1, completed in 1940, had an initial output of 644 b.d., but later had mechanical and sand troubles. An offset is to be drilled. G. D. H.

1538. New Chile Field Seen in Wildcat now Testing. Anon. *Oil Gas J.*, 15.7.48, **47** (11), 58.—1 San Sebastian, 50 miles south of Spring Hill, has recovered an oil-bearing core from Cretaceous or Jurassic beds. The horizon has not been tested. Casing has been set at about 7200 ft, and drilling is to be continued for further geological data. G. D. H.

1539. Development of Casabe and Tibu fields Boosts Total 1947 Output in Colombia. Anon. *Oil Gas J.*, 20.5.48, **47** (3), 126.—Colombia produced 25,881,322 brl of oil in 1947, 3,323,115 brl more than in 1946. In 1947 Casabe produced 4,775,610 brl and Tibu 4,574,508 brl; the 1946 figures were 3,210,046 brl and 2,932,080 brl respectively. 139 development wells, 132 of them producers, were completed in Colombia in 1947. The development of Infantas and La Cira was completed. The results of Cretaceous tests at Tibu are said to be discouraging. The Floranto field was abandoned, and only two wells, one dry, were completed at Velasquez.

Eighteen wildcats were completed in 1947. 1 Chaviva was abandoned dry at 7824 ft. Voragine reached basement. A deep Cretaceous test was spudded 94 miles north of Bogota. 1 San Antonio in the Upper Magdalena basin reached 8363 ft without finding oil or gas showings. Several high-pressure gas shows were found in 1 Pinto in the southern Lower Magdalena basin, and the well was abandoned in Oligocene at 11,206 ft. 1 Granada, 9 miles to the north, was lost at 3870 ft because

of a fire. The well is estimated to have flowed 50–75 million cu. ft. of gas per day. 17 El Dificil was abandoned in basement at 9528 ft. It had several small oil shows.

1 Buenavista has been abandoned in the Tertiary at 11,590 ft. Both 1 and 2 Tubara had encouraging shows of medium-gravity oil, but were abandoned. 1 El Paso in the Cesar Valley basin was in basement at 2927 ft. A wildcat in the Papayal basin was abandoned in basement at 2900 ft.

10 Floresanto was abandoned in Oligocene at 10,876 ft. 1 La Risa, 12 miles to the east, was also abandoned. Neither well had significant oil or gas shows. 1 Tablon in the eastern part of the Sinu basin had a big show of dry gas. 1 San Andres was drilling in the Cretaceous at 5135 ft at the end of 1947. Later it was abandoned at 7400 ft. G. D. H.

1540. Venezuelan Oil Industry Heading for New High Records in All Divisions. D. H. Stormont. *Oil Gas J.*, 29.7.48, **47** (13), 155.—Currently Venezuela's oil output is about 1,315,000 b.d., 125,000 b.d. more than the 1947 average. In mid-July there were 135 active rigs, thirty-one being exploratory. Sixty rigs were working in Eastern Venezuela. Thirteen geophysical and twelve geological parties were at work in Western Venezuela, and fourteen geophysical and nine geological parties in Eastern Venezuela. In Western Venezuela much exploratory work is directed towards new Cretaceous limestone production. New fields may be 2000–4000 ft deeper than at La Paz and Mara. At Mara twelve wells now give 45,000 b.d.; La Paz thirteen wells yield 127,000 b.d.

1 Pailas, 9 miles south of Cumarebo, is testing at 9959 ft, and 1 Santa Cruz, near Dabajuro, is drilling below 4809 ft. Cretaceous tests are to be drilled on the Los Canadones concession and at Alturitas. 12° oil has been found by Richmond southwest of Lake Maracaibo. 14° production is reported in the Eocene and 28° oil in the Cretaceous.

An Eocene pool has been found in Barinas. No. 2 Silvestre is reported to be capable of over 800 b.d. on a ¼-in choke from sands at 8600–9400 ft.

1 Placer in Eastern Venezuela is drilling below 8200 ft. Ten wells have been completed in the Tucupito field at 5000–5500 ft. The Saban field has production at 900 ft. G. D. H.

1541. Crude from Guarico Area of Venezuela now Reaching World Markets. D. H. Stormont. *Oil Gas J.*, 26.8.48, **47** (17), 82.—A pipeline from the Mercedes field to Pamatacual was opened in May. The opening throughput was about 10,000 b.d. This pipeline will also serve the Tucupido field, and later the Saban field to the south.

178 wells have been drilled in Guarico involving expenditure of over $100 million. The Las Mercedes company has drilled 137 wells, opening the Las Mercedes and Palacio fields. In the Grico area a producer has been completed.

The exploratory activities of various companies are briefly described.

The Mercedes wells are 4100–4400 ft deep. Gas injection is to be undertaken.

The discovery well at Tucupido was completed at 6858 ft. The Saban discovery well was drilled to 5474 ft. G. D. H.

1542. Pantepec Extends El Roble Production in Venezuela. Anon. *Oil Gas J.*, 24.6.48, **47** (8), 141.—Production at El Roble has been extended 1300 yd west by a well which on test gave 1400 b.d. The most easterly and westerly producing wells are 3¾ miles apart, and the most northerly and southerly wells 3 miles apart. G. D. H.

1543. French Oil Industry Has Extensive Wildcatting Programme under Way. W. W. Burns. *Oil Gas J.*, 10.6.48, **47** (6), 56.—About 125 wildcats are planned for southwest France, seventy-five elsewhere in the country, and some 100 in French colonies. Pechelbronn produces about 1000 b.d., and had 83,584 ft of development drilling in 1947. The Puy Maurin test was abandoned at 12,941 ft. Wildcats were abandoned, or are drilling at Plagne, Richou, Castelon, Saint Martory, Garlin, La Vaunage, Bastennes-Gaujacq, Guissac, and Castelnau. A wildcat at Saint Gaudens is reported to have found oil.

In Morocco a well at Petit-Jean, completed late in 1947, produced 126 b.d. About thirty-five wildcats have been drilled in Morocco, ranging from 312 to 3450 ft in depth. Eight wildcats, 1412–5100 ft deep, have been abandoned in Algeria this year. Two

wildcats are being drilled at El Haroune and Cap Bon in Tunisia. A wildcat is under way at Mabora in Gabon. G. D. H.

1544. The Search for Petroleum in the Aquitaine Basin. P. Maugis. *Bull. Ass. franç. Tech. Pétrole*, Aug. 1948, 19–43.—The western part of the Aquitaine basin has Miocene beds. Eocene is seen in the first folds of the Pyrenees, and Mesozoic beds to the south. The history of the basin dates from the Trias, and marls, clays, salt, gypsum, and limestone were deposited. The plastic formations have given rise to diapirs. Deeper, marine deposits were formed in the Jurassic, in which there are breccias, dolomites, marly limestones, black clayey marls, and oolites, some of these rocks being porous. A stratigraphic break occurs at the top of the Jurassic and base of the Cretaceous. A narrow zone of subsidence existed in the Cretaceous. There are marls and reef limestones. Some lava flows have been found. Some folding movements began in the Cretaceous. Flysch deposits were formed and passed northwards into marly limestones, limestones, and sandstones. There was a return to marine sedimentation in the ensuing period, and this continued in the west in the Miocene.

Porous limestones occur in the Eocene, Danian, and Cretaceous. In the Lower Cretaceous, Jurassic, and Trias are porous horizons beneath marls. Flysch marls also act as cap-rocks, and at Saint-Marcet gas has been found in Cenomanian breccias. Gas indications are also found in sandstones and conglomerates in the flysch.

Bitumen has been worked at Bastennes; gas seeps occur at Échourdes. Oil traces have been noted in shallow wells in the Castagnède region. Evidences of hydrocarbons and saline waters are known elsewhere.

The structures are anticlines, faults, and diapirs. The Saint-Marcet structure is the most westerly of three highs on an anticline. It is covered by thick flysch deposits. In the core is a Triassic diapiric mass beneath faulted Jurassic and Cretaceous limestones and marls. Some folds have been eroded to the Cretaceous. At Bastennes-Guajacq a Triassic diapir passes through the Cretaceous and younger beds. Saint-Marcet produces 500,000 m^3 of gas/day and 3 metric tons of oil. A well on the Plagne structure had gas shows. Gas shows have been noted in a well on the Richou fold. Evidences of oil were found in the Lower Cretaceous and Jurassic in the Puymaurin well. The Audignon well had slight oil impregnation in the Albian and Lias. Garlin 1, situated on a geophysical high, entered Trias at 1960 m. Evidence of hydrocarbons was noted from the base of the Eocene to a brecciated rock overlying the Trias, in which gas was observed. A well is to be drilled to test beds on the flank of the diapir. On the Saint-Medard structure, gas and salt water were noted in compact dolomitic limestone in the Trias. G. D. H.

1545. Stratigraphical Work Undertaken by the Société Nationale des Pétroles du Languedoc Méditerranée. The Upper Jurassic of Bas-Languedoc. M. Gottis and H. Tintant. *Rev. Inst. franç. Pétrole*, Mar. 1948, **3** (3), 76–82.—The area investigated lies in the Gard Department and in the eastern half of Hérault. Fossil evidence has shown the presence of Callovian, regressive Divesian, and Argovian. In the east was a trough with thick pelagic sediments containing *cephalopods*. In the centre are neritic deposits (limestones and dolomites) pointing to a high. There were marine oscillations from the Callovian to the Argovian. The lower Callovian has a deep facies; the middle Callovian has marls. In the Upper Callovian, the truly marly facies withdrew towards the southeast. In the Divesian, the sea progressively withdrew from the continental shelf, and all the region north of a line from St. Paul-et-Valmalle to Sommières emerged. The sea transgressed in the Argovian. The area studied was completely invaded in the middle Argovian. To the south, the presence of a relatively marly facies and the entire Divesian indicates deeper water and thus the margin of the continental shelf. There are signs of deepening of the sea to the west. G. D. H.

1546. Secondary Recovery of Crude Oil in Germany. W. Ruhl. *Producers' Monthly*, May 1948, **12** (7), 16.—The general geological conditions in the German oilfields are reviewed, and secondary recovery methods in the individual fields are briefly discussed. R. B. S.

1547. Spanish Wildcat Dry. Anon. *Oil Gas J.*, 3.6.48, **47** (5), 46.—The wildcat on the Oliana structure is to be abandoned at 7622 ft. G. D. H.

1548. Geology of Ethiopia Being Developed by Sinclair in Exploring Concession. H. Taylor. *Oil Gas J.*, 12.8.48, **47** (15), 48.—The mountainous northwestern part of Ethiopia has Triassic and Jurassic sediments covered by thick Tertiary lavas. The Abyssinian graben also has great thicknesses of lava through which sediments are reported to be exposed in a few places. Both areas appear unpromising from the point of view of oil. The Somali platform has several thousand feet of sands, limestones, shales, and gypsum. It is apparently a remnant of a great Middle and Upper Mesozoic basin in which were deposited marine beds and evaporites. The regional dips are to the south and east. The pre-Mesozoic basement is exposed on the edge of the Somali plateau southeast of the Abyssinian graben. Overlying the basal sandstones is a nodular fossiliferous marly Upper Jurassic limestone with a shaly basal part. Shales and marls follow and might be source beds. Then come further limestones, marly and pure, with gypsiferous and sandy layers near the top. The succeeding beds are primarily gypsiferous, with shales and marls. Definite Cretaceous limestones come next, followed by more gypsum, then Cenomanian limestones grading upwards into sandy Turonian beds. Next comes a thick sandstone series overlain in the eastern part of Ogaden by Eocene limestone interfingering with gypsiferous beds to the north and east. G. D. H

1549. International Developments. Anon. *Oil Gas J.*, 20.5.48, **47** (3), 124.—5 Qatar has been completed as a producer at a total depth of 5807 ft. G. D. H.

1550. International Developments. Anon. *Oil Gas J.*, 29.7.48, **47** (12), 51.—The Asl field, 10 miles south of Sudr, found production at about 3900 ft. It has one producer. Sudr has eight oil wells and produces 7500–8000 b.d.

25 miles west of Abqaiq on a 125-mile-long anticline, a well at Ain Dar has found 250 ft of oil-bearing sand. G. D. H.

1551. International Developments. Anon. *Oil Gas J.*, 13.5.48, **47** (2), 198.—The Kariana wildcat in New Guinea has been abandoned at 12,621 ft.

1 Blafuon in Syria was in the Judea limestone at 6299 ft, and 1 Dola was coring in limestone and black shale at 4765 ft. G. D. H.

Geophysics and Geochemical Prospecting.

1552. Economics of Aerial Magnetics. C. J. Deegan. *Oil Gas J.*, 22.7.48, **47** (12), 67.—Under favourable conditions the aerial magnetometer can be used economically on an area as small as 20 miles wide and 20–25 miles long. A plane must have a base and a maintenance organization. The only productive time is that in which the plane is flying with the magnetometer in action. This can be kept high by covering a large area from a single base, or a series of small areas involving only short moves between jobs. Bad weather is an impediment. The surveying phase is most important. Shoran may be economically satisfactory for large areas. For small areas ground maps or aerial photographs may be available, and can be used by the magnetometer plane pilot.

Drift must be allowed for, and there must be adjustments for diurnal variation. A network of control points is established for this purpose. The aerial magnetometer records the total magnetic field. For an accuracy of 1 gamma the control points must not be more than 10–15 min flying time apart.

Generally it is safe to assume that the slower the plane the smaller the area that can be surveyed economically. A flying crew of at least three is necessary.

The flying magnetometer is a reconnaissance instrument. G. D. H.

1553. Lorac—a New Surveying Method for Over-water Exploration. C. J. Deegan. *Oil Gas J.*, 17.6.48, **47** (7), 58.—Surveying is a major bottle-neck in over-water geophysical work. Tentatively plans have been made for installations which will allow Lorac to be used for off-shore surveying from the Rio Grande to Mississippi Sound. This system employs medium wavelength radio, the waves of which follow the earth's curvature and involve fewer common electrical problems than high-frequency systems. The accuracy is claimed to be better than ± 150 ft at the 100-fathom mark, and ± 60 ft nearer shore.

The boat equipment requires no highly skilled operator. On land are three fixed radio stations. By indirect measurement of the times of the waves to reach the boat, its position is defined. The boat observer merely reads two dials and refers to a map printed with lines corresponding to the dial readings, and the intersection of the lines corresponding with these readings defines the boat's position.

The principles underlying Lorac and some of the instrumental features are briefly described. G. D. H.

1554. Technique and Problems in Marine Exploration. R. L. Palmer. *Oil Gas J.*, 24.6.48, **47** (8), 160.—Between Brownsville, Texas, and Mobile, Alabama, the shelf area out to 60 ft of water is 11 million acres. Between 60 and 120 ft there is 10 million acres, and 120 to 600 ft a further 16 million acres.

The first off-shore reconnaissance was by refraction seismic shooting. In 1945 the reflection method was used to check refraction leads. The equipment has been developed to employ as many as twenty-four traces, at times with multiple detectors per trace. Surveying is one of the main problems. Radar and Shoran have been used, both employing line-of-sight equipment with a limit of 10–15 miles. Wire-line measurements have also been made with buoys to mark points. Painted 5-gal cans or small balloons are used as temporary buoys. More permanent buoys employ a metal cone with a rod to keep it upright and a flag on top, and these are commonly put in small groups to serve as a check on movement.

Small boats must take shelter in rough weather. Larger boats may be able to work more continuously. 85- to 120-ft boats may provide suitable living-quarters.

Originally, charges were exploded on the sea floor. Later, regulations were made requiring that they should be suspended at least 5 ft. off the floor. Multiple charges may be employed to minimize the bubble effect. The features of various types of spread are described. The " wide-angle " method reduces troubles due to ground roll.

There are various arrangements for the detectors and cables. Some detectors are floated above the cable which is dragged along the sea-floor. Better results are obtained with detectors on the sea-bed. Detectors may be built into the cable. Cables may be floated with suspended detectors. G. D. H.

Drilling.

1555. Drillable Bridging Plugs. S. H. King. *World Oil*, May 1948, **128** (1), 199.—The requirements of drillable bridging plugs and the uses to which they may be put, are reviewed. R. B. S.

1556. Concrete Pipe for Surface Casing. N. Williams. *Oil Gas J.*, 12.8.48, **47** (15), 66.—The casing is in 14-ft. lengths, inside dia 10 in, outside dia 14 in, reinforced by nine ¼-in rods wrapped diagonally in two directions with ¼-rod welded every 4-in. Ends are fitted with steel collars welded to the reinforcing rods. Collars are made with lock joints and grooves for a Neoprene ring gasket to ensure positive seal under compression. Casing is designed for a maximum setting depth of 2500 ft. A special guide shoe is provided for cementing the string. C. G. W.

1557. Jet Casing Cutter. H. David. *Oil Gas J.*, 12.8.48, **47** (15), 85.—The lowest point of free casing is determined electronically, and the cutter run to this depth and the pipe severed. The entire operation required only 2 hr. The cutter contains a combustible fluid ignited electrically from the surface. Jet action of the burning fluid severs the pipe instantly, the cutter also being destroyed. C. G. W.

1558. Progress of the Drilling Industry. Part II. C. W. Alcorn. *World Oil*, Jan. 1948, **127** (9), 77.—A study of deep-drilling requirements is presented: the following are discussed: (1) derricks; (2) derrick substructure; (3) crown block; (4) travelling block; (5) wire rope; (6) drilling hook; (7) drill-pipe elevators; (8) casing elevators; (9) casing spiders; (10) swivel; (11) rotary hose; (12) drill pipe; (13) tool joints; (14) drill collars; (15) rock bits; (16) drawworks engine; (17) drawworks; (18) rotary table; (19) power-operated casing and drill-pipe slips; (20) equipment for

making up, breaking out, and racking drill pipe; (21) core reel units; (22) boilers; (23) steam lines; (24) slush pumps; (25) blow-out preventers; and (26) well-surveying instruments. (See also Abstract No. 858 (1948).) R. B. S.

1559. Prevention of Drill String Failures in the Permian Basin. Part I. R. C. McMaster. *World Oil*, Apr. 1948, **127** (13), 75.—Examination of typical drill-pipe failures in the field and in metallurgical laboratories revealed that in many cases the deterioration started on the inside surface of the drill pipe and progressed very rapidly as a result of intense corrosive action: the corrosion was especially severe on the inside surface. Other drill-pipe failures were traced to external causes, such as mechanical damage to the outer surface of the drill pipe, or unreasonable overloading. The mechanism of drill-pipe corrosion and the corrosion-fatigue properties of drill-pipe steel are discussed and photo-micrographs are presented of typical corrosion pits and fatigue cracks in drill pipe.

Laboratory tests were made of each of the practical methods of improving the operating life of the drill string. Protective coatings of plastic or zinc were found to prolong the operating life under corrosion-fatigue conditions. Although these coatings can only be maintained on the inside surface of the pipe this provides significant protection since field observations indicated that most failures propagated from corrosion pits on the internal surface. Alternatively, chemical inhibitors may be added to the drilling fluid, which will protect the outer as well as inner surfaces of the pipe, and also the threads, tool joints, and mud pumps. Sodium chromate was found to be the most satisfactory inhibitor for use in drilling operations. R. B. S.

1560. Prevention of Drill-String Failures in the Permian Basin. Part II. R. C. McMaster. *World Oil*, May 1948, **128** (1), 134.—Laboratory tests showed that periodic cleaning of the drill pipe to remove the products of corrosion tends to prevent deep corrosion pitting and thus to reduce the probability of the occurrence of a corrosion-fatigue failure. Field-pipe inspection methods and recommended drilling practices are discussed. R. B. S.

1561. Economic Trends in Contract Drilling. J. E. Warren. *World Oil*, Dec. 1947, **127** (8), 91 (*Paper presented before A.P.I. Chicago*, Nov. 1947).—The basic principles pertaining to studies of the economics of drilling programmes are reviewed. R. B. S.

1562. Reducing Drilling Expenses. G. D. Hughes. *World Oil*, Apr. 1948, **127** (13), 84.—Several techniques, designed to reduce drilling costs, are described. R. B. S.

1563. Completion Methods. E. C. Wells, Jr. *World Oil*, June 1948, **128** (2), 86.—Dual completion practices in the Illinois Basin are described. R. B. S.

1564. Oceanography in the Offshore Drilling Campaign. C. C. Bates and A. H. Glenn. *World Oil*, Apr. 1948, **127** (12), 114.—The utility of the science of oceanography in solving problems which arise in connexion with drilling on the Continental Shelf is discussed under the following headings: (1) wave action; (2) tidal action; (3) currents; (4) marine biology; (5) fouling; (6) corrosion; and (7) water supply. Twenty references are appended. R. B. S.

1565. Discovering Oil 12 miles Offshore in the Gulf. A. T. F. Scale. *World Oil*, May 1948, **128** (1), 113.—The equipment and methods used in exploratory drilling in the Louisiana Gulf area are described. R. B. S.

1566. Amphibian Drilling Goes Deep-Sea. E. Sterrett. *World Oil*, June 1948, **128** (2), 77.—A description is given of the equipment used in off-shore platform drilling. R. B. S.

1567. Chemistry of Drilling Fluids. H. T. Kennedy. *World Oil*, Apr. 1948, **127** (13), 90.—The colloidal chemistry of water-base muds is briefly discussed: the effect of various materials on the properties of muds is also discussed. Six references to literature and ten to patents are appended. R. B. S.

1568. Preparation of Drilling Muds for Laboratory Investigations. W. E. Bergman, H. B. Fisher, and P. G. Carpenter. *Oil Gas J.*, 19.8.48, **47** (16), 96.—Laboratory-prepared muds are better for investigation purposes since the composition is better controlled. Dispersion of the muds is effected by a colloid mill, and extensive tests are carried out. Ageing of the suspensions yields stable systems not appreciably altered by the tests.

Results of tests are tabulated. C. G. W.

1569. New Developments in Drilling Fluids. J. P. Weichert. *Oil Gas J.*, 26.8.48, **47** (15), 101.—Major recent developments in mud technique include: (1) use of "red muds"—high-pH calcium-base muds useful for drilling colloidal shales and high-salt concentrations; (2) starch, carboxymethyl cellulose, and similar organic colloids have been used to control water loss and for drilling salt sections; (3) oil-base and oil-emulsion muds—the latter have many of the advantages of oil-base muds and can be handled as ordinary muds; (4) sodium silicate muds have been found effective in cases of lost circulation and heaving shale. C. G. W.

1570. Giant Rig for Deepest Marine Drilling. E. Sterrett. *World Oil*, Mar. 1948, **127** (12), 75.—A description is given of a barge rig designed for 18,000-ft drilling under most severe conditions: it combines heavier equipment with air-operated controls. R. B. S.

1571. Automatic Drilling Rig. L. S. McCaslin, Jr. *Oil Gas J.*, 5.8.48, **47** (14), 58.—Humble's new rig embodies many automatic features. Two of the newest and most important of these are a remote-control pipe racker and remote-control power tongs. Making and breaking joints and racking drill pipe is now controlled mechanically by a derrick man and floor man with control handles, with a helper to latch and unlatch elevators. Some of the other many features of the rig are: (1) high fluid velocity bits; (2) automatic bit weight and feed-off control; (3) hydraulic rubber slips; (4) air compressor operating throttles and greasing unit. C. G. W.

1572. Weeks Island Salt Dome. N. Williams. *Oil Gas J.*, 2.9.48, **47** (18), 58.—On the north sector of this dome nine wells producing from depths 12,400–14,000 ft have been drilled. Four potentially productive sands have been logged.

Initial flows have been from 500 to 800 b.d., tubing pressures 2000–2400 p.s.i., oil gravity 34° A.P.I.

Drilling has presented problems in keeping straight hole, and preventing sticking and twist-offs of drill pipe. There have been numerous fishing and sidebreaking jobs. Originally phosphate muds were used, then "red muds" and more recently starch and lime mud. Mud weights average 11·5 lb/gal. Progress has been made in reducing costs and drilling time—wells to 14,000 ft can be drilled within 100 days at costs of less than $200,000. C. G. W.

Production.

1573. Practical Dynamometer Card Interpretation. W. H. Titterbusch. *World Oil*, Mar. 1948, **127** (12), 152.—Twelve dynamometer cards, taken from actual well tests, are discussed in comparison with the ideal card, in order to illustrate the manner in which they may be used to interpret actual pumping conditions. R. B. S.

1574. Acidizing Procedure. C. E. Clason. *World Oil*, Feb. 1948, **127** (10), 148.—The various factors which must be considered in order to obtain maximum results from acidizing are discussed. Two references are appended. R. B. S.

1575. Effect of Water Injection in Air–Gas Drive. D. E. Menzie. *Producers' Monthly*, Nov. 1947, **12** (1), 28 (*Paper presented at the 11th Annual Secondary Recovery Conference, Pennsylvania State College*, Oct.–Nov. 1947).—Laboratory experiments designed to test the effect of water injection during an air–gas drive on long cores are described, and the results are presented graphically. The cores used were taken from the Cow Run (Ohio) sand and from the Venango sand. The results of these experiments show that: (1) there is an increase in oil recovery from these cores when combined air–water

injection is practised instead of straight air injection; (2) there is a further increase of recovery when the water is injected intermittently instead of continuously; (3) there is a reduction in the air volumes required for each barrel of oil produced; (4) by-passing of air and producing gas–oil ratios are reduced; and (5) these results could be obtained on the cores used even when the connate water saturation was above the irreducible minimum water saturation.

Seven references are appended. R. B. S.

1576. Plugging-Off Cavities in University Field. F. E. Bryson. *World Oil*, June 1948, **128** (2), 100.—A description is given of a cementing technique which has been used successfully for plugging off lime cavities in University Field, Lousiana. R. B. S.

1577. Corrosion Fatigue of Oil Well Equipment. B. B. Morton. *World Oil*, Apr. 1948, **127** (13), 156.—General considerations of fatigue failure and mechanism of corrosion are discussed. Five references are appended. R. B. S.

1578. Some Examples of Successful Gas Repressuring in North Texas. R. Gouldy and G. Stine. *Producers' Monthly*, Mar. 1948, **12** (5), 21 (*Paper presented before North Texas Oil and Gas Association, Wichita Falls*, Mar. 1948).—Some details are given of gas-repressuring projects in North Texas, and several production-decline curves are presented. R. B. S.

1579. Calculation of the Effect of Pressure Maintenance on Oil Recovery. R. L. Hoss. *World Oil*, Mar. 1948, **127** (12), 129.—A method is described for calculating the effect of pressure maintenance by gas injection on the ultimate recovery of oil from solution-gas-drive reservoirs. The method is based on the equations of Muskat, which are evaluated numerically by assuming that the various properties of the reservoir fluids remain constant over a short interval of pressure decline.

Three references are appended. R. B. S.

1580. Some Results of Gas and Water Drives on a Long Core. C. R. Holmgren. *Petrol. Tech.*, July 1948, **11** (4); *A.I.M.M.E. Tech. Pub. No.* 2403, 1–15.—A sandstone core 6 ft long and 5¼ in dia was used in the experiments. Water saturations were determined electrically and the total mass of the core, and hence the oil saturation, by gamma rays. Gas drive, water drive, and water drive combined with gas injection were carried out. The gas-drive experiments indicated a greater ultimate recovery at high-pressure gradients, but this conclusion may not be entirely sound. With connate water present and a low-pressure gradient during gas drive less gas was needed to produce a given amount of oil than with high-pressure gradients.

The water-drive experiments indicated that oil recovery is not a function of gradient or input rate. The presence of a relatively high initial gas saturation in the core before water drive gave a slightly lower final oil saturation than when there was no gas present. Injection of sufficient gas to maintain the initial gas saturation during water drive resulted in a lower final oil saturation. G. D. H.

1581. Lance Creek Sundance Reservoir Performance—a Unitized Pressure-maintenance Project. L. F. Elkins, R. W. French, and W. E. Glenn. *Petrol. Tech.*, July 1948, **11** (4); *A.I.M.M.E. Tech. Pub. No.* 2401, 1–27.—Unit operation of the Lance Creek Sundance reservoir for ten years has provided data on the utilization of gravity drainage augmented by primary pressure control with gas injection into structurally high wells. A series of maps provide data on well status, reservoir pressure, individual well recovery. In addition there are pool-performance charts. A study of the reservoir behaviour indicates only minor water encroachment. Hence gravity drainage, gas injection, and gas expansion must be the main oil-expelling agents.

A simple theory of gravity drainage is presented and checked with good order-of-magnitude agreement by means of comparisons of "reservoir" and "well" permeabilities. The theory affords a means of estimating maximum gravity drainage.

Individual well performance and overall reservoir performance indicate the possibility that pressure maintenance renders ineffective those parts of the reservoir in which permeability is too low to permit effective gravity drainage of oil. Oil from these parts can be recovered only when pressure is reduced locally by selective withdrawal or when overall reservoir pressure is finally reduced. G. D. H.

1582. **Comparison of Gas Lift and Rod Pumping in the Same Field.** E. L. Petree. *Oil Gas J.*, 26.8.48, **47** (15), 124.—The technical developments concerning gas-lift equipment are outlined, and the installation of gas-lift equipment in the field described. Comparison of production costs per brl of fluid give gas lift a slight advantage over rod pumping over a period of five years. However, rod pumping produces 65% water compared with gas-lift's 18%. Also the investment cost per well is $7000 for rod pumping to $2200. The availability of ample reserves of high-pressure gas and the absence of major technical difficulties usually associated with gas-lift—construction and maintenance of gas-distribution system, emulsion troubles, etc., led to the adoption of gas-lift for oil production. C. G. W.

1583. **Methods of Paraffin Removal.** B. F. Grant. *World Oil*, Apr. 1948, **127** (13), 142.—The various methods of paraffin removal are discussed under the following headings: (1) solvents; (2) heated solvents; (3) electrical heating; (4) the Mosser heater; (5) steaming; and (6) heat-producing chemicals. Under the latter heading the use of the following chemicals are discussed: (1) calcium carbide; (2) caustic soda (lye); (3) caustic soda and metallic aluminium; (4) Berite (a patented cleaning mixture). The application of an open flame to the sand face of a well is also discussed, but this method is not recommended for paraffin removal.

Twenty-one references are appended. R. B. S.

1584. **Condensate Production and Cycling. Part 13.** P. J. Jones. *World Oil*, Feb. 1948, **127** (10), 154.—The influence of the degree of cycling and pressure maintenance with water on ultimate condensate recovery and volume of gas produced is discussed. R. B. S.

1585. **Condensate Production and Cycling. Part 14.** P. J. Jones. *World Oil*, Mar. 1948, **127** (12), 148.—The economics of condensate production methods are discussed. One reference is appended. R. B. S.

1586. **Condensate Production and Cycling. Part 15.** P. J. Jones. *World Oil*, Apr. 1948, **127** (13), 164.—The optimum rate of condensate production for cycling or water injection varies with structure, stratigraphy, pay thickness, permeability, richness of gas, and other factors. These basic data for a hypothetical radial reservoir, termed the R-1 reservoir, are presented in this part. R. B. S.

1587. **Condensate Production and Cycling. Part 16.** P. J. Jones. *World Oil*, May 1948, **128** (1), 208.—The basic data for the R-1 reservoir presented in Part 15 are used to illustrate a method to optimize a cycling programme and a pressure-maintenance programme by water injection. R. B. S.

1588. **Condensate Production and Cycling. Part 17.** P. J. Jones. *World Oil*, June 1948, **128** (2), 166.—The preparation of a cycling programme is discussed and illustrated by use of the data of a hypothetical reservoir. R. B. S.

1589. **A Study of Cycling Operations in the West Austin Sands.** C. B. Johnson and F. H. Dotterweich. *World Oil*, May 1948, **128** (1), 178.—A study is presented of the case history of two relatively lean reservoirs in the West Austin sands in which cycling operations were conducted. Three references are appended. R. B. S.

1590. **Cycling at High Pressures *versus* Depletion and Cycling at Low Pressures.** E. O. Bennett. *World Oil*, Mar. 1948, **127** (12), 160.—The economics of cycling operations are discussed. R. B. S.

1591. **Pressure Maintenance and Cycling Plants.** E. K. Parks. *World Oil*, Feb. 1948, **127** (10), 138.—The results of the application of pressure-maintenance projects in some Californian fields are discussed. R. B. S.

1592. **Peak Tension Rating for V-Belts.** D. O. Barret. *World Oil*, June 1948, **128** (2), 163.—A method for rating and selecting V-belts for pumping-unit drives is described. R. B. S.

1593. Hazards in Salvaged Pipe. F. R. Cozzens. *World Oil*, June 1948, **128** (2), 158.—The hazards involved in completing wells with salvaged pipe are discussed, and precautionary measures which should be observed are summarized. R. B. S.

1594. Transformer Connections for Oil Well Pumping Distribution Systems. J. N. Poore. *World Oil*, June 1948, **128** (2), 155.—A method is described for connecting single-phase transformers to form a three-phase bank. R. B. S.

1595. Experimental Production Projects and Exploratory Drilling at Elk Hills. M. C. Eastman and F. L. Ruhlman. *Petrol. Tech.*, July 1948, **11** (4); *A.I.M.M.E. Tech. Pub. No.* 2404, 1–28.—At the end of the recent war, production at Elk Hills was reduced from the wartime peak of 65,000 b.d. to the current rate of 8000, b.d. in order to conserve crude for emergencies. Various experimental production projects were started and a long-range exploratory programme was commenced. The latter was intended to determine the amount of recoverable oil in the unexplored parts of the Reserve. The Shallow zone exploration is almost complete. The deeper Stevens zone is structurally more complex, and has an oil reserve estimated at 250 million brl in fractured shale.

The current producing rate is considered essential in order to carry out the experimental production projects. These are being conducted to find the best methods and means of keeping the Reserve shut in, but in a state of readiness to produce the maximum amount of oil expeditiously when needed. The projects include: (*a*) protection of surface equipment; (*b*) repair of wells that might damage the reservoir; (*c*) gas injection; (*d*) water encroachment; (*e*) gravity drainage.

The techniques employed and the results obtained to date are described in detail.
G. D. H.

1596. A Critical Review of Methods Used in Estimation of Natural Gas Reserves. H. J. Gruy and J. A. Crichton. *Pertol. Tech.*, July 1948, **11** (4); *A.I.M.M.E. Tech. Pub. No.* 2402, 1–15.—The reasons for estimating natural-gas reserves are enumerated, and the volumetric and decline-curve methods of estimating non-associated gas reserves are described and critically discussed. Methods of estimating associated and dissolved gas reserves are briefly discussed.

Common errors in estimating gas reserves include: (*a*) application of the pressure curve of an early well to later wells on a per well or per acre basis; (*b*) construction of pressure-decline curves from arithmetic average pressures when well spacing is not uniform and the number of wells not constant; (*c*) failure to check decline-curve estimates by volumetric calculations; (*d*) neglecting deviations from Boyle's law.
G. D. H.

1597. Homogeneous Permeability Determination. S. T. Yuster. *Producers' Monthly*, Nov. 1947, **12** (1), 35 (*Paper presented before A.P.I. Chicago*, Nov. 1947).—The results of various investigators in the field of homogeneous permeability determination are discussed and compared. Twelve references are appended. R. B. S.

1598. A Study of the Flow of Homogeneous Fluids through Ideal Porus Media. Part III. J. C. Calhoun and S. T. Yuster. *Producers' Monthly*, Aug. 1947, **11** (10), 32 (*Paper presented before A.P.I. Chicago*, Nov. 1946).—The procedure adopted in using the relative homogeneous liquid permeability apparatus described in Part II is further discussed.

A description is given of the apparatus and procedure used in the homogeneous gas-permeability determinations. Two methods were used. In one a constant volume of gas was used; the permeable membrane was sealed in a glass tube connecting two large glass reservoirs; an arrangement was made for unbalancing the pressures in the two reservoirs and thus causing flow of gas through the porous media in an effort to establish equilibrium: the gas permeability at a given mean pressure could be calculated from readings of pressure differentials at various time intervals, and of mean pressure, which remains constant.

In the other method a continuous flow of gas is maintained and constant upstream and downstream pressures are maintained by a system of needle valves, using a constant-pressure gas supply.

The data obtained from these experiments are presented tabularly and graphically. The results, which are discussed, are essentially as indicated by Klinkenberg.
R. B. S.

1599. A Study of the Flow of Homogeneous Fluids through Ideal Porous Media. Part IV. J. C. Calhoun and S. T. Yuster. *Producers' Monthly*, Sept. 1947, **11** (11), 22 (*Paper presented before A.P.I. Chicago*, Nov. 1946).—The remaining results of the investigation are presented and discussed. These data are essentially in agreement with the data of Klinkenberg: the relationship between apparent gas permeability and reciprocal of mean pressure is not exactly linear, but the reasons for this cannot be adequately explained at present. Measurements of gas permeability at different pressure differentials gave the same value so long as the mean pressure was constant, and no variation of liquid permeability with temperature was detected as found by Grunberg and Nissan: liquid permeability was found to be essentially in agreement with the value for gases at infinite mean pressures. An anomaly was found to exist in the measurement of liquid permeability of porous media to ionic solutions, as detected by Grunberg and Nissan, and is evidenced by an increase in permeability: no adequate explanation of this phenomena could be postulated.

This paper concludes a series of four papers published in the May, July, August, and September 1947 issues of the *Producers' Monthly*. (See also Abstracts Nos. 1425 (1947), 69 and 1598 (1948).) Ten references are appended. R. B. S.

1600. Permeability; Absolute, Effective, and Measured. H. M. Ryder. *World Oil*, May 1948, **128** (1), 173.—The permeability of oil sands is discussed, and the distinction between absolute, effective, and measured permeability is stressed. The effect of grain size, pore size, and shape, and of adsorbed surface films on oil-sand permeability is also outlined. Thirteen references are appended. R. B. S.

1601. Studies in Relative Permeability. J. H. Henderson and S. T. Yuster. *World Oil*, Mar. 1948, **127** (12) 139; *Producers' Monthly*, Jan. 1948, **12** (3), 13 (*Paper presented at 11th Annual Secondary Recovery Conference, Pennsylvania State College*, Oct.–Nov. 1947).—A description is presented of an apparatus for determining relative permeabilities of small core samples: a typical test procedure is also described. The apparatus was constructed so that measurements of relative conductivities across the cores could be made and so that fluid saturations could be determined by a weighing procedure. Several relative-conductivity–saturation curves were plotted: these showed that the relative conductivities varied, not only with the brine saturations, but also with the nature of the other fluid phase present and with the applied pressure. Thus a single relative conductivity–saturation curve cannot be used to estimate brine saturations under all conditions, but a constant resistance reading during a flood is a valuable indication that steady-state conditions exist.

Six references are appended. R. B. S.

1602. Calculation of Initial Fluid Distribution in Oil Reservoirs. M. Muskat. *Petrol. Tech.*, July 1948, **11** (4); *A.I.M.M.E. Tech. Pub. No*, 2405, 1–9.—The application of capillary-pressure curves obtained by drainage in calculating fluid distributions in inter-phase transition zones involves a number of difficulties:—

(1) the development of very low non-wetting-phase saturations seems to be inconsistent with the lack of mobility at such saturations as shown by permeability-saturation studies;

(2) dispersed non-wetting phases are thermodynamically unstable;

(3) discontinuous phases should not be subject to hydrostatic equilibrium requirements.

Although these difficulties could be removed by assuming that the capillary-pressure drainage curve has an initial horizontal segment, they can be avoided by using the imbibition capillary-pressure curve for the lower part of the water–oil transition zone. The latter curve generally shows zero displacement pressure at only partial wetting-phase saturations.

Counter-current upward flow of oil into the main oil-saturated pay and downward drainage of water suggest that wetting-phase imbibition processes will determine the saturation distribution immediately above the water-saturated section. Comparable arguments can be applied to the oil–gas transition zone. In the transition zones so defined, the oil begins with a non-vanishing saturation at the water–oil contact, and ends with a similar saturation at the top of the gas–oil contact. The gas–oil transition zone begins with an equivalent non-vanishing gas saturation.

G. D. H.

1603. Fluid Distribution and Relative Permeability in Sand. H. M. Ryder. *World Oil*, June 1948, **128** (2), 142.—The effect on production of the positions of the reservoir fluids within the pores is discussed. The differentiation between oil-wet and water-wet sands is stressed and hypothetical photomicrographs based upon experimental information are illustrated and used to show the manner in which fluids may be expected to move through the sands under various methods of production and the particular sand conditions. Nine references are appended. R. B. S.

1604. Characters of Pores in Oil Sand. H. M. Ryder. *World Oil*, Apr. 1948, **127** (13), 129.—The nature of pores in oil sands is discussed, and photomicrographs of wax casts of pores of Bradford Oil Sand are presented. A study was made of the shape and size of the pores and of the nature of the pore surfaces in cores taken from the Bradford and Burkburnett sands.

In many cases a pigment material was found adsorbed on to the sand grains and the resulting pore surface affected the properties of the sand. In the sands studied, iron compounds and complex organic polar compounds were found adsorbed on the sand-grain surfaces.

It appears that if, in addition to the available data on porosity, permeability, and fluid saturations, some information were available on pore characteristics (*i.e.*, shape and size of pores and nature of the sand-grain surfaces), then the actual mechanics of oil retention and oil removal for that sand would be determinable.

Ten references are appended. R. B. S.

1605. A Study of Medina Sand Production in the Philo Pool, Muskingum County, Ohio. W. P. Krauswick. *Producers' Monthly*, May 1948, **12** (7), 28.—The geological and production characteristics of the Medina sand are discussed, and the effects of thickness and structural characteristics in relation to productivity are examined. R. B. S.

1606. Sand Variations in the Bradford Field. M. M. Stephens. *Producers' Monthly*, Dec. 1947, **12** (2), 30.—Sand variations in the Bradford Field are discussed in detail, and numerous sectional diagrams are presented of sand intervals in producing wells. These diagrams are based on evidence obtained from cores. R. B. S.

1607. Effect of Shot-Hole Dimensions on Oil Production Costs. F. R. Cozzens. *World Oil*, Mar. 1948, **127** (12), 156.—The effect of shot-hole size on the rate of production is discussed; the manner in which shots may be regulated to equalize the effect on the sand is also described. R. B. S.

1608. Selective Plugging with Smoke. R. F. Nielsen. *World Oil*, Feb. 1948, **127** (10), 132; *Producers' Monthly*, Dec. 1947, **12** (2), 15 (*Paper presented at 11th Annual Secondary Recovery Conference, Pennsylvania State College*, Oct.–Nov. 1947).—The general methods of preparing smokes or suspensions of solids in gases are: (1) by mechanical dispersion of a fine powder in an air or gas stream; (2) by quenching the vapours of a volatile solid by a cold gas stream; (3) by chemical reaction between two gases resulting in the precipitation of a solid; and (4) by atomization of a solution of a solid in a volatile solvent with subsequent evaporation of the solvent.

Laboratory and field tests involving some of these methods are described. Whilst most of these methods gave fair results in the laboratory, those necessitating passing the smoke down the tubing did not prove successful in field tests. One method in which the smoke was formed at the sand face by alternate injection of ammonia and hydrogen chloride gave a reduction of about 50% in gas intake rate, but the plug was not permanent. Two references are appended. R. B. S.

1609. Economics of Secondary Oil Recovery. W. B. Berwald. *World Oil*, Jan. 1948, **127** (9), 142 (*Paper presented before A.P.I. Chicago*, Nov. 1947).—The factors of general significance in determining the economics of individual secondary recovery operations are discussed. R. B. S.

1610. Conservation and Secondary Recovery. J. P. Jones. *Producers' Monthly*, Feb. 1948, **12** (4), 18.—The mechanics of natural production and the principles of conservation and secondary recovery are discussed. Results of secondary-recovery projects in various fields of the U.S.A. are outlined. The need for secondary-recovery production research is also stressed. R. B. S.

1611. Secondary Recovery Operations and Related Problems. D. B. Taliaferro. *Producers' Monthly*, Apr. 1948, **12** (6), 22 (*Paper presented before Mid-Continent District, Division of Production, A.P.I., Wichita, Kansas*, Mar. 1948).—The results of some secondary-recovery projects in the Mid-Continent area are reviewed, and some of the problems met with in these operations are discussed. Three references are appended. R. B. S.

1612. Cost Study of a Water Flood in the Bradford Field. J. K. Barton and R. G. Prentice. *Producers' Monthly*, Feb. 1948, **12** (4), 27.—A cost study is presented of an actual water-flood development in Pennsylvania. R. B. S.

1613. Secondary Recovery of Oil by Water Flooding in Fields of North Texas. R. K. Guthrie, J. W. Amyx, and D. B. Taliaferro. *Producers' Monthly*, Mar. 1948, **12** (5), 28.—Some secondary recovery water-flood projects in North Texas are discussed. Most of North Texas oil production is from marginal or near-marginal wells, producing from reservoirs in which most of the natural energy has been supplied by gas rather than by encroaching water. The relatively small size of many of the reservoirs involves comparatively higher operating costs, and the thin, broken character of the producing horizons results in a relatively low water-flood oil recovery. R. B. S.

1614. Theory of Nine-Spot Flooding Networks. M. Muskat. *Producers' Monthly*, Mar. 1948, **12** (5), 14.—An analytical equation is derived from which the sweep efficiency of nine-spot flooding networks can be calculated for various input well pressures. This equation is discussed and used to show how the sweep efficiency of the nine-spot network varies with the various pertinent factors. R. B. S.

1615. Water Flooding Opportunities Explored by Gas Injection. F. Squires. *World Oil*, Apr. 1948, **127** (13), 136.—A knowledge of the continuity of oil sands and of their permeability is important in choosing areas that are suitable for water flooding. In fields where water flooding is preceded by gas repressuring this information can be obtained by studying the behaviour of the field during gas injection.

The relative permeabilities of the sand may be measured by the time required for injected gas to travel from the input to the output wells. The direction and extent of permeable areas may be ascertained by shutting in the output wells and studying their pressure behaviour whilst continuing gas injection. The continuity of a sand may be determined by the use of a tracer gas. R. B. S.

1616. Slug Feeding of Sodium Hypochlorite on Water-flood Leases. J. K. Barton, G. F. Brown, and E. T. Heck. *World Oil*, May 1948, **128** (1), 194; *Producers' Monthly*, Feb. 1948, **12** (4), 24.—A brief description is given of the method and equipment used for water treatment in a water-injection project in the Bradford–Allegany area. R. B. S.

1617. Economic Aspects of Water Flooding in North Texas. W. Krog. *Producers' Monthly*, Mar. 1948, **12** (5), 18 (*Paper presented before North Texas Oil and Gas Association, Wichita Falls*, Mar. 1948).—A brief cost analysis is presented of two water-flood projects in North Texas. R. B. S.

1618. Water Flooding in Kentucky. H. S. Barger. *Oil Gas J.*, 5.8.48, **47** (14), 78.—The problems and practices of water flooding in Kentucky are discussed. Pertinent factors and operating principles are briefly presented. C. G. W.

Oilfield Development.

1619. Evaluating an Oil Property. E. A. Nichols. *Oil Gas J.*, 12.8.48, **47** (15), 68.—Evaluation of an oil property consists in estimating the recoverable reserves and probable value of such reserves, and the salvage value of field equipment.

Tests made on wells include oil production, water production, gas–oil ratio, oil gravity and viscosity, producing and static bottom-hole pressures, and in the case of pumping wells the fluid level is valuable. In the case of gas wells, samples should be taken for P.V.T. data and the gas temperature at the well-head measured.

Inventories of all field equipment should be made and well completion and past production data collected.

This data is then used to obtain production-decline curves, volumetric estimation of reserves, pressure-decline–recovery curves, recovery factors for dissolved gas- or water-drive mechanisms, and the economics of producing and marketing of the oil. Methods and equations for evaluating this data are presented. C. G. W.

1620. Total of 17,837 Wells Completed in First Half is All-time High. J. C. Casper. *Oil Gas J.*, 29.7.48, **47** (13), 169.—17,837 wells were completed in the U.S.A. in the first half of 1948, 2858 more than in the same period in 1947. The footage was 64,409,000 ft, an increase of 8,650,000 ft. 3032 wildcats were completed in the first half of 1948, 620 more than for the corresponding period of 1947. The wildcats included 474 oil wells and 129 gas wells.

Tables summarize the completion results by States for the first half of 1948. The data are also presented under the subdivisions development and wildcat completions; in addition they are grouped by months, and there is a summary according to drilling methods. G. D. H.

1621. Gulf Coast Maintains Lead in Scope of Deep Drilling and Development. N. Williams. *Oil Gas J.*, 24.6.48, **47** (8), 184.—As of May 1, 1948, 327 wells had exceeded 12,000 ft on the Gulf Coast; three had exceeded 16,000 ft. At least sixteen Gulf Coast fields have production below 12,000 ft, the deepest being Queen Bess Island giving gas-condensate at 13,879–13,904 ft. Weeks Island has the deepest crude-oil production at 13,888 ft. This field has prospects of still deeper production. Six Gulf Coast fields produce oil or condensate below 13,000 ft.

Tables list the Gulf Coast wells deeper than 13,000 ft, with a note on the results, the number of wells drilled yearly below 12,000 ft and their distribution by States, together with a list of the producing wells deeper than 12,000 ft. G. D. H.

1622. More than 675 Drilling Rigs, Third of Nation's Total, Running in Gulf Coast Area. N. Williams. *Oil Gas J.*, 24.6.48, **47** (8), 193.—675 rigs are spread over much of the 75–125-mile wide Gulf Coast strip primarily engaged on wildcat, semi-wildcat, and field-extension exploration. Over 5000 wells are projected for this area in 1948, and of these 1500 are wildcats. 1521 wells were completed in the first four months of 1948; 910 produced oil or gas. 471 of these completions were wildcats. Thirty-five new fields have been found since the beginning of 1948, most being apparently small. The Gulf Coast has 1078 producing fields—812 in Texas, 228 in Louisiana, thirty-five in Mississippi, two in Alabama, and one in Florida. To March 1, 1948, the cumulative output was 4476 million brl (3095 million brl from Texas, and 1,273,600,000 brl from coastal Louisiana). Currently production exceeds 1,423,000 b.d. Remaining oil reserves at the beginning of the year were estimated at over 6977 million brl. Ten fields have produced over 100 million brl each; twelve other fields have passed 50 million brl each. At present four fields give over 50,000 b.d. each.

Tables show the drilling activity by States at the beginning of each month in 1948, the numbers of fields discovered in each State yearly since 1930, and the numbers and types of completions in each month of 1948 for the different States.

G. D. H.

1623. Annual Survey of Gulf Coast Oil and Gas Fields. Anon. *Oil Gas J.*, 24.6.48, **47** (8), 275.—A table gives the fields alphabetically by districts with the discovery year, numbers of flowing and pumping wells, daily average output, cumulative production to the beginning of March 1948, depth, and name of producing formation. A series of maps show the positions of the fields. G. D. H.

1624. Magnitude of Water Flooding Production in Kansas. A. E. Sweeney. *Producers' Monthly*, Apr. 1948, **12** (6), 30 (*Paper presented before Mid-Continent District Division of Production, A.P.I. Wichita, Kansas*, Mar. 1948).—Some details of water-flood production in Kansas are discussed very briefly. Four references are appended. R. B. S.

1625. Pennsylvania Crude Industry in 1947. G. G. Bauer. *Producers' Monthly*, Feb. 1948, **12** (4), 31.—Pennsylvania crude-oil production and crude runs to stills are summarized for 1947. R. B. S.

1626. Virginia Wells Respond to Acid—Increase Interest. Anon. *Oil Gas J.*, 24.6.48, **47** (8), 341.—Two Trenton wells at Rosehill have shown increased production after acidization. In one case production rose from 1½ to 250 b.d., in the other from 6 to 700 b.d. In both cases the flow fell off rapidly, but was still much above the pre-acidization level. G. D. H.

1627. Mexico Achieves Greater Oil Output in 1947; Further Increase Seen this Year. W. W. Burns. *Oil Gas J.*, 13.5.48, **47** (2), 200.—In 1947 Mexico's crude output was 56,110,515 brl; the 1946 output was 49,239,800 brl. Twenty-two wildcats were drilled in 1947, only three being productive. 57% of the 1947 production was from Poza Rica, 18% from the Tampico district, 11% from the Golden Lane, and 11% from the Isthmus of Tehuantepec. The Poza Rica reserves are estimated at 932 million brl, Tampico at 90 million brl, and the southern zone at 36 million brl.

A table summarizes the development position in 1947. G. D. H.

1628. Argentine Crude Output Increasing under Y.P.F. Drilling Programme. W. W. Burns. *Oil Gas J.*, 3.6.48, **47** (5), 42.—Argentina produced 21,841,000 brl of oil in 1947. Y.P.F. completed 105 wells in 1947. There were ten wildcats, of which five found oil and one found gas. Two wildcats at Challaco produced. A gas well and an oil well were completed in the Caleta Olivia region. A successful wildcat was completed on the Barrancas structure.

Comodoro Rivadavia produced 9,913,900 brl in 1947, Plaza Huincul 2,024,900 brl, the Salta region 471,500 brl, and the Mendoza region 2,847,600 brl.

Tables summarize the results of wildcat and development drilling in 1947, and give salient data on the various fields. G. D. H.

1629. News From Poland. F. Wirth. *Petroleum*, July 1948, **11**, 156.—Statistics are presented for the 1947 production of the Polish oilfields. They show that the anticipated level of production has been exceeded in all sections of the industry. There has been a steady and marked increase in gasoline production.

New developments include the discovery of a new natural gas field promising to surpass the resources of Deboweic which are rated at 3000 million cu. m.

During 1947 two coal-distillation plants were set up, and a 60-mile pipeline was constructed from Deboweic to Cracow.

Bituminous shale, containing some 8% of combustible matter as well as a substantial proportion of sulphur, has been discovered at Grybow.

Intensive research into production methods and efficiency of the various refineries has been carried out. Output of crude oil and gas is expected to increase during the present year. F. W. H. M.

1630. Foreign Production Shows Mid-year Increase of 374,000 brl Daily. W. W. Burns. *Oil Gas J.*, 29.7.48, **47** (13), 179.—Exclusive of Russia and the Baltic countries production outside U.S.A. in the first half of 1948 averaged 3,005,000 b.d., compared with 2,652,000 b.d. in the first half of 1947.

A new field, Ain Dar, has been found 27 miles west of Abqaiq.

A table gives by countries the average daily production of the above countries during the first half of 1948, together with the 1938 and 1947 figures. G. D. H.

1631. International Developments. Anon. *Oil Gas J.*, 10.6.48, **47** (6), 54.—478 rigs, mainly rotaries, are reported to be operating in forty-five countries outside the U.S.A., and excluding Russia and Russian-dominated areas. Some 500 are believed to be in use in Russia, and twenty-one in Austria, Poland, and Czechoslovakia. A table gives the information by countries.

A new oil discovery is reported to have been made near the Hodonin field in Czechoslovakia. G. D. H.

1632. New Zealand Oil Industry. A. L. Kidson. *Petroleum*, June 1948, **11**, 133.—New Plymouth is the main producing area in New Zealand. During the past sixteen years, supplies have been drawn by the local refinery from six separate wells, three of which are still producing. The Moturoa No. 2 well has yielded about 1½ million gal of crude oil.

Recent exploration by the world's largest oil concerns has discovered no fresh

deposits. At Moturoa, however, two wells drilled in 1931 proved good producers, and the refinery treating their output has cracked about 2 million gal of crude. The products have all been sold in local markets. Further extension of the Moturoa field is envisaged. F. W. H. M.

1633. Mining for Oil in Japan. G. B. Shea. *Producers' Monthly*, Dec. 1947, **12** (2), 19.—A detailed study is presented of oil-mining operations undertaken by the Japanese in the Hiyashiyama oilfield, Niigata Prefecture. R. B. S.

Transport and Storage.

1634. Problems of Laying Trans-Arabian Line. Anon. *Pipe Line News*, Sept. 1948, **20** (9), 5.—The line, 30 in dia, 37 miles long runs from Abqaiq to Qatif. Burial of the entire length of line was not feasible owing to corrosion and excavation problems, and part of the line was supported above ground on steel bents and concrete supports. Above-ground sections are fully restrained, *i.e.*, charges of direction greater than about 1° are fully anchored.

Owing to the non-uniform nature of the terrain, ditching necessitated using a combination of ditching machine, rooter backhoe, and blasting.

Corrosion protection is effected by petrolastic asphalt coating, glass-gloss wrap, and a final flood coat of asphalt. This is supplemented by cathodic protection. The line is being extended to the region of Abu Hadinga. C. G. W.

1635. Aluminium Pipe Lines for Oil and Gas. H. S. Bell and C. R. Holmes. *World Oil*, Feb. 1948, **127** (10), 169.—The use of aluminium as an alternative pipeline material during the present steel shortage is discussed. R. B. S.

1636. Pipe Line Corrosion. M. E. Parker. *World Oil*, Apr. 1948, **127** (13), 184.—The mechanism of pipeline corrosion and corrosion protection methods are briefly discussed. R. B. S.

1637. Application of Centrifugal Compressors to High Pressure Gas Transmission. B. D. Goodrich. *Pipe Line News*, Sept. 1948, **20** (9), 9.—When the Texas Eastern Transmission Corp. took over the Big Inch and Little Big Inch pipelines, they were faced with the necessity of converting an oil system to gas transmission as economically as possible. Also the system must be easily reconvertible to oil transmission.

Installation of centrifugal compressors with electric drive was considered. Apart from certain technical difficulties, advantages of the centrifugal compressors are: (1) first cost similar to other compression equipment; (2) maintenance and operating costs lower; (3) are essentially high-capacity machines; (4) can be designed to be interchangeable with existing oil pumps; (5) electrical systems were already installed in the stations. The technical difficulty of this compressor has been the shaft sealing unit and this has been largely overcome.

In operation the compressors are adaptable to automatic operation and to economical compression ratios and are self-regulating over a wide range of capacity.

The great limitation in the general use of these machines is the prime mover. A variable-speed prime mover is desirable which raises problems in first cost and upkeep.

In view of the fact that this is an entirely new application of the machines, and that the machines had to be adapted to the existing system, performance to date is considered good.

It is believed that where an entire system is designed for an existing capacity satisfactory operation will be possible. C. G. W.

1638. High Pressure Gas Measurement. Z. C. Ambrose. *World Oil*, May 1948, **128** (1), 188.—Some of the problems encountered in high-pressure-gas measurement are reviewed, and methods for their solution are suggested. R. B. S.

1639. Estimating Gathering System Meter Run Sizes. J. B. Arant. *World Oil*, May 1948, **128** (1), 206.—Graphs are presented which enable preliminary computations for

field-meter runs to be made with a minimum of calculation. These graphs include all anticipated pressure and volume ranges for gas-gathering systems. Their use is illustrated by numerical examples. R. B. S.

1640. Measures Adopted by Ajax Pipeline to Operate Pump Stations at High Efficiency. C. P. Morgan. *Oil Gas J.*, 19.8.48, **47** (16), 106.—The Ajax pipeline system, built in 1930, connects Interstate and Ohio Oil Co. systems. Measures adopted to maintain 99·8% maximum possible throughput are :—

(1) Use of portable pumping equipment during overhaul of pumping units. The mechanical gang moves in, connects portable equipment, and repairs the permanent units one by one, then re-connects main units and moves portable equipment to the next station.

(2) Development of a thorough overhaul procedure.

(3) Many mechanical improvements have been designed and installed, which prevent breakdown, reduce operating costs, and speed up repair time. These include closed cooling-water systems, lubricating-oil filters, engine pyrometers, and safety and warning devices. W. M. H.

1641. Special Characteristics of Centrifugal Pumps for the Transfer of Products of Varying Viscosity. I. G. Es'man and S. A. Gross. *Neft. Khoz.*, 1948 (6), 51–55.—The use of centrifugal pumps on trunk pipelines is considered. For handling liquid of varying viscosity a flat form of characteristic is undesirable; the curve should be a steeply falling one and not have a "hump." For dealing with liquids having a viscosity up to 1·6 $cm^2\ sec^{-1}$ a speed control of 8–10% is advisable; in the case of pumps driven by asynchronous three-phase motors direct electrical speed variation is complicated, but adequate control can be obtained by the use of hydraulic couplings. V. B.

1642. Investigation of the Hydraulic Resistance of Special Crimped Gasoline-resistant Hoses and Stop Valves. I. L. Chernyak. *Neft. Khoz.*, 1948 (6), 55–59.—Determinations of the hydraulic resistance (using water at 5° C) were made on hoses and valves (both of U.S.S.R. manufacture). The coefficient for hoses increases slightly with a decrease in Reynolds No.; it is also increased by looping the hose. Data for hoses of 1–4 in dia for Reynolds No. of $10^4 - 1{\cdot}5 \times 10^5$ are shown graphically. The local resistance due to various types of valve placed in the circuit was likewise investigated. V. B.

1643. Heating Reduces Tank Bottom Reconditioning. M. H. Pearce. *World Oil*, June 1948, **128** (2), 152.—A thermosyphon system is described for breaking up paraffin deposits and preventing sludge formation in certain types of paraffin-base crudes. R. B. S.

1644. Gauging Methods in Atmospheric and Low Pressure Storage. C. C. Keane. *World Oil*, Jan. 1948, **127** (9), 170.—Some recent improvements in tank gauging methods are discussed. R. B. S.

1645. Tank Tapping. M. H. Pearce. *World Oil*, Apr. 1948, **127** (13), 181.—Some methods are described which enable tank farm value and pipeline maintenance to be effected without taking tanks off the line, and without the necessity of performing tedious and expensive purging operations. R. B. S.

1646. Skimming Pit Cleans Run-off Water. E. Sterrett. *World Oil*, Mar. 1948, **127** (12), 184.—Details are given of a skimming pit designed to prevent pollution of surface streams by run-off water. R. B. S.

1647. Oil Tanker Progress. R. Hammond. *Petroleum*, July 1948, **11**, 149.—New tanker trends are discussed with special reference to the turbo-electric *Helicina* and *Hyalina*. An innovation is the burning of cracked asphalt in the boilers of the latter vessel.

The success of the use of heavy fuel oil as diesel fuel in the modified engines of the *Auricula* hinges on the use of the centrifugal separators (De Laval type) to purify and clarify the fuel; temperature control of the oil is also adequately arranged.

The uses of variable-pitch propellors and of aluminium in tanker construction are described. Experiments pending with gas-turbine prime movers are mentioned.

Details of recent orders undertaken by British shipbuilders are given, and the controversy on welding in shipbuilding is discussed. F. W. H. M.

Refinery Operations.

Refineries and Auxiliary Refining Plant.

1648. Lobitos Oilfields Ltd., Refinery at Ellesmere, Cheshire. Anon. *Petroleum*, Aug. 1948, **11**, 173.—A full description of the Lobitos Refinery, which has facilities for crude-oil treatment and distillation, lub.-oil treatment by solvent and acid refining. Cracking facilities include a conventional Dubbs type thermal unit.

The refinery was designed for Peruvian crude, which is naphthenic and eminently suitable for production of white and medicinal oils. During the war, English crude was handled.

Blending and packaging plant is described and details of laboratory accommodation are given. The article is illustrated with photographs of interesting features. F. W. H. M.

1649. Sand Blasting Useful in Cleaning Variety of Metal Surfaces. F. Gober. *Oil Gas J.*, 2.9.48, **47** (18), 80.—The technique employed by the Humble Oil & Refining Co. in their Baytown refinery for cleaning heat-exchanger bundles is described.

Ungraded river sand is used for the abrasive in the sand-blasting process, and a recent addition to the equipment is a wet-blast machine which considerably reduces dust and has an effect on sparking.

It is necessary that passages between and in tubes should not be blocked entirely before the operation, and with closely spaced tubes care must be taken not to completely foul the interior of the bundle. G. A. C.

1650. Sulphuric Acid *versus* Construction Materials. (Symposium.) Anon. *Chem. Engng*, May 1948, **55** (5), 235.—The presentation is the first of a series on materials of construction. Five basic materials are discussed.

(*a*) Rubber linings are considered very satisfactory within definite concentration and temperature limits. Various types of rubber can be used for special duties, and many types of chemical plant incorporate rubber linings.

(*b*) Cast iron and steel are particularly useful in the 80–100% concentration range, and also 102% and over.

(*c*) Worthite. This chrome–nickel alloy has found much use over a wide concentration range, the higher concentrations being withheld at increased temperature. This material has been used for treating sludge, separating, circulating, and alcohol recovery. It may be used for 30–66° Be acid (up to boiling point).

(*d*) Hastelloy. All four grades, A, B, C, and D, are extensively used in handling sulphuric acid—particularly for heating coils, blow pipes, steam legs, agitating equipment, pumps, and valves. In the petroleum industry these alloys find application for processing inorganic chemicals and others such as *iso*propanol and ethanol. The "D" alloy is also used in hot-sludge-acid pumps.

(*e*) Stainless steel. Care must be exercised with all commercial acids, as the impurities are liable to affect corrosion rates severely. The stainless steels incorporating molybdenum are the most useful varieties. Moderate concentrations of *pure* acid attack these steels severely, but with impure acids, attack is often slight, particularly when sulphates are present. R. T. W. H.

1651. Sunray Converts Facilities at Duncan with Minimum of New Equipment. R. B. Tuttle. *Oil Gas J.*, 26.8.48, **47** (17), 137.—Work involved in converting existing plant into a complete unit for manufacture of products for current markets consisted of installing crude-oil-processing facilities; a vacuum unit, a visbreaker, treating equipment for straight-run gasoline and naphtha, and a polymerization plant. Most of the equipment was salvaged from other units. G. A. C.

1652. Welded Stainless Steel Plant. H. Seymour, *Petroleum*, July 1948, **11**, 157.—Discusses welding of stainless steel in relation to corrosion resistance in chemical plant.

Also described are the uses of colombium-treated 18-8 rod, classification of stainless steels, and welding requirements. F. W. H. M.

1653. A.C. Motor Trouble. W. L. Nelson. *Oil Gas J.*, 2.9.48, **47** (18), 91.—No. 212 in the *Refiners' Notebook* series lists possible troubles with electric (A.C.) motors, giving symptoms, causes, and remedies.

Matters dealt with include overheating, hot bearings, non-starting, tardy acceleration, and noises, etc., and instructions for dealing with same are given. G. A. C.

1654. Engineered Maintenance. S. B. Schapiro. *Oil Gas J.*, 26.8.48, **47** (17), 112.—An overall maintenance programme at the Texas City refinery of Pan American Refining Corporation is described.

All engineering functions were centralized in a single department and separated into: (1) design and development, and (2) construction and maintenance.

Separation of staff and line-supervisory responsibilities in the mechanical department followed, a work-order system established, and a stabilized working force put in being.

Several weeks prior to a turn-around, the work is planned, listed, and timed, and co-ordination of the operation arranged.

Two figures are given, one a functional chart, the other a chart of mechanical-department supervisory staff. G. A. C.

Distillation.

1655. Tower Pressure Drops. Refiners' Notebook No. 210. W. L. Nelson. *Oil Gas J.*, 19.8.48, **47** (16), 131.—While theory indicates that pressure drop is a square function of the vapour velocity, experimental data shows the relationship to be more nearly linear. Liquid flow has a pronounced effect on pressure drop, while an increase in vapour density usually causes pressure drop to be smaller.

A table gives experimental data from commercial trays, including the new Koch Kascade tray. Figures are given as inches of water pressure drop per plate, with slot velocities 4–20 ft/sec; liquid flow 100–1800 g.p.h./sq. ft.; and vapour densities 0·2–1·4 lb/cu. ft. W. M. H.

1656. Eight-Shell Still Battery Handles 24,000 Brl of Crude Daily. A. L. Foster. *Oil Gas J.*, 19.8.48, **47** (16), 116–120.—Sinclair Refining Co., at Marcus Hook, have developed a system of operating two shell still batteries which handle 65,000 brl of crude daily.

Each battery consists of eight shells, connected so that the bottoms from each lower still are introduced into the next shell continuously. The first four stills have primary fractionator towers, the second four secondary fractionators.

Crude is charged to external heat exchangers at 1000 brl/hr, preheated to 300° F, flashed in a crude fractionator where light gasoline vaporizes overhead, and crude at 347° F enters the first stills, 45 and 46. Pressures here are 18–19 p.s.i.a., and drop 0·3–0·4 lb in each succeeding still till the last, which operates at slightly above atmospheric pressure and produces 17·5° A.P.I. gravity-reduced crude bottoms which are pumped to other units. A solvent naphtha fraction is taken overhead from still 47, kerosine from 49, and gas oil from 51 and 52.

In all, nine streams are produced from the battery, varying from light gasoline of 76° A.P.I. gravity to the 17·5° gravity reduced crude.

Flow diagrams and tabulations of inspection data illustrate the article. W. M. H.

1657. Miniature Topping Plant Develops Pipeline Station Fuel. L. S. McCaslin. *Oil Gas J.*, 2.9.48, **47** (18), 69.—A miniature fuel vaporizer plant has been installed at the Sunbeam Station (Northwest Colorado) of the Stanolind Pipe Co. for providing fuel in an out-of-the-way location, where natural gas is uneconomic or unavailable.

Four 300-h.p. vaporizers comprising 30 in dia by 10 ft long horizontal shells mounted on skid bases with 12 in dia by 8 ft long horizontal gasoline condenser with storage tanks above, complete the unit.

The waste heat of the engine exhausts is used to distil the fuel, the crude feed is taken from main oil line at any pressure up to 50 lb. G. A. C.

1658. Control of Narrow Boiling Range Fractionating Columns. G. G. Gallagher. *Petrol. World*, July 1948, **45** (7), 26.—See Abstract No. 1068 (1948).

Absorption and Adsorption.

1659. Benton Unit Cycling Plant. H. W. Manley. *Oil Gas J.*, 19.8.48, **47** (16), 82.—The Benton plant is designed to handle 50 million cu. ft of produced gas per day and to recover and store in liquid form 35% of propane, 80% of butanes, and 98% of pentanes plus contained in the total produced gas. The location and design are such that any well can be tested with full-scale test-separator conditions without interrupting production from other wells. Corrosion is kept under control by chemical inhibitors. Three absorption-pressure levels are used, and recording flow meters are provided on about fifty streams in the plant area. Emergency alarm and shutdown equipment are provided where advisable.

High-pressure "D" sand gas flows to the three distillate separators, then to the distillate stripping unit, where propanes and some butanes and pentanes plus are removed. Stripped distillate passes to the topping tower, where motor fuel is taken off overhead, and kerosine and gas oil from side streams.

Bodcaw production is stripped of crude oil before passing to the absorbers. Equipment and details of processing are discussed fully, and illustrated by flow sheets. Storage and blending equipment used are also described. W. M. H.

Solvent Extraction and Dewaxing.

1660. Extraction and Dewaxing of Lubricating Oils. H. Ter Meulen. *Ingenieur*, 3.9.48 (36), M43–M49.—The constituents of lub. oils are divided into fractions as follows: asphaltenes, unstable to oxidation and therefore undesirable; paraffins, too high pour points and undesirable; aromatics, unstable to oxidation and undesirable; naphthenic, stable and desirable; *iso*paraffins, stable and desirable.

By the selection of a suitable solvent extraction process (which should consist of three principal parts: (1) apparatus for mixing the oil and solvent and for the separation of raffinate and extract; (2) apparatus for the recovery of solvent from the raffinate phase; (3) apparatus for the recovery of solvent from the extract phase) lub. oils possessing the desired qualities of stability against oxidation and sensitivity to temperature changes can be prepared.

For dewaxing the following solvents are used: (1) ketones, *e.g.*, acetone, M.E.K., M.I.B.K., plus benzol toluol; (2) liquid propane; (3) chlorinated hydrocarbons, *e.g.*, chloroform, ethylene dichloride; (4) paraffinic hydrocarbons, *e.g.*, naphtha, F.B.P. 100–150° C; (5) SO_2 with benzol or toluol.

A brief description of the M.E.K. benzol dewaxing process is given together with a description of the continuous band filter. Ten diagrams are included in the article. N. C.

Cracking.

1661. New Process for Thermal Cracking of Ethane. Anon. *Canad. Chem. & Proc. Industr.*, July 1948, **32** (7), 633.—In answer to the demand in Germany for ethylene as base material in the manufacture of synthetic lubricants, a thermal-cracking process for ethane was developed. Cracking of desulphurized gas was carried out at about 800° C, and the product was passed over a nickel oxide–chromium oxide catalyst for conversion of acetylene to ethylene followed by passage through an aqueous solution of copper nitrate–ethanolamine which absorbed the olefinic compounds. Ethylene is removed from this complex with copper–ethanolamine by expansion. O. M.

1662. Production of Olefins by Catalytic Cracking of Mineral Oils. V. Berti, G. Salvi and V. Ghisoni. *Riv. Comb.*, 1947, **1** (3), 129–148.—The effect of various catalysts in the cracking of mineral oils on the production of gaseous mixtures containing a greater

proportion of olefins was studied. A further aim was to produce the greatest proportion of olefins higher than ethylene. The best results were obtained with alumina and with silica–alumina mixtures. D. H. McL.

1663. Thermofor Pyrolytic Cracking. S. C. Eastwood and A. E. Potas. *Oil Gas J.*, 26.8.48, **47** (17), 104.—A new process has been developed by Socony Vacuum Co. for high-temperature low-pressure cracking to produce ethylene and aromatics. The process is similar to the T.C.C. process in that hydrocarbon feed is contacted continuously with a moving bed of coals.

The new system comprises two main elements, a reactor and a heater.

The process has wide flexibility with respect to charge stock, efficient heat transfer from the primary source to the hydrocarbons being cracked, rapid heating of charge to high cracking temperature, continuous elimination of coke, and ability to introduce charge stock to reactor without preheat.

Tables give yields from charge stock for ethylene and aromatics. G. A. C.

Special Processes.

1664. Nitration of *cyclo*Hexane in the Vapour Phase. A. Quilico and R. Fusco. *Chim. e Industria*, 1948, **30** (5–6), 135–139.—The nitration of *cyclo*hexane was studied in the course of a search for a new synthesis of caprolactam. The optimum temperature for formation of nitro*cyclo*hexane was 370° C when 2 mols hydrocarbon to 1 mol nitric acid ($d = 1{\cdot}4$) were employed. The velocity of *cyclo*hexane feed was 2 g/hr/cm^3. Under these conditions 7·7% of the *cyclo*hexane went to the nitro-compound, this being 65% of the *cyclo*hexane effectively consumed. As by-products CO and N_2O were in greatest quantity, but short-chain fatty acids and dibasic acids (succinic, glutaric, and adipic) were also formed. D. H. McL.

Metering and Control.

1665. Velocity Head. W. L. Nelson. *Oil Gas J.*, 26.8.48, **47** (17), 159.—No. 211 in the *Refiners' Notebook* series gives a formula $P = 0{\cdot}000673\ SU^2$ for pressure loss (velocity head) when P is p.s.i., S is specific gravity of the fluid, and U is the velocity in feet per second. A table shows the value of velocity-head losses against rate of flow in gal per min for refinery fluids. G. A. C.

Safety Precautions.

1666. Mechanical Foam for Fighting Petrol Fires. S. Weintroub. *Nature*, 1948, **162**, 158.—In 1939 an investigation into the problem of foaming agents for combating fires was undertaken in Great Britain, with emphasis on the production of mechanical foam by churning air and water with a suitable foam stabilizer. The physical properties of foam were investigated in the laboratory, and large-scale methods of estimating quantitatively the value of foams were worked out. The best foam stabilizer was found to be chemically treated blood, which had the additional advantage of low viscosity. Plateau's classical theory of foam stability has been experimentally confirmed from consideration of interfacial tension, age of the surface, and diffusion of active material into the surface. As a result of these experiments the value of foam on a petrol fire can be roughly estimated, but not accurately predicted, from laboratory measurements of foam properties. H. C. E.

1667. Butadiene–crotonaldehyde Explosions. K. W. Greenlee. *Chem. Eng. News*, 1948, **26**, 1985.—Precautions are recommended for carrying out the Diels–Alder reaction with butadiene and crotonaldehyde with safety. E. S. E.

1668. Pressure Equipment Hazard. E. S. Hanson. *Chem. Eng. News*, 1948, **26**, 2551.—In performing autoclave experiments, it is essential to base the charge on the calculated liquid volume at the reaction temperature, because of the rapid thermal expansion of liquids at temperatures near the critical point. E. S. E.

PRODUCTS.

Chemistry and Physics.

1669. Conversion of Xylose to Furfural by Means of Hydrobromic Acid. G. A. Adams and A. E. Castagne. *Canad. J. Res.*, 1948, **26B** (3), 309–313.—From the experiments for the conversion of xylose to furfural it is concluded that hydrobromic acid has no advantage over other acids now in general use. The yield is *ca* 93%. D. F. J.

1670. Some Factors Affecting the Determination of Furfural. G. A. Adams and A. E. Castagne. *Canad. J. Res.*, 1948, **26B**, 314–324.—Describes the results of studies on the photo-calorimetric determination of furfural and their application to acid distillates of xylose and a variety of plant materials. Twenty-four references. D. F. J.

1671. Detection of Free Radicals in Hydrogen Atom Reactions with Organic Molecules. G. M. Harris and A. W. Tickner. *Canad. J. Res.*, 1948, **26B**, 343–355.—The Paneth–Rice free-radical-detection technique has been applied to the study of Wood–Bonhoeffer hydrogen atom (H)–organic molecule reactions. It has been demonstrated that bismuth is a satisfactory "mirror metal," and a method is described for the preparation of radioactive bismuth mirrors of known specific activity. Two systems were studied: H–acetone and H–dimethyl ether. Whereas the acetone reaction gave no evidence for the formerly postulated existence of free alkyl radicals, conclusive positive results were obtained in the dimethyl–ether reaction. The results are discussed in some detail and twenty-six references are given. D. F. J.

1672. Knock Characteristics of Sixteen Pure Gaseous Hydrocarbons. F. E. Frey, R. V. Kerley, and W. G. Lovell. *Oil Gas J.*, 2.9.48, **47** (18), 61.—Measurements have been made of the knock tendency of sixteen pure gaseous hydrocarbons, using normally aspirated and supercharged engines under a variety of conditions similar to those of other investigations.

The knock characteristics range in critical compression ratios from 5 to 15 or in relative performance numbers from 60 to 300 may correlate with molecular structure.

Isomeric compounds, and even those in which the isomerism is in the position of a double bond, may vary considerably in knock tendency.

Stereoisomeric compounds show no significant difference. The olefins may be superior or inferior in knock rating to the corresponding paraffins, and their relative value is greatly influenced by engine conditions.

Data shows that the effectiveness of T.E.L. in the gaseous hydrocarbons varies over a considerable range.

Two tables and seven figures illustrate the article. G. A. C.

1673. Chemical Reactions Produced by Ionization Processes. J. O. Hirschfelder. *J. Phys. & Colloid Chem.*, 1948, **52**, 447–450 (*Symposium on Radiation Chemistry & Photochemistry, University of Notre Dame, Notre Dame, Indiana*, June 24–27, 1947).—Chemical reactions produced by ionizing radiation are studied in terms of a sequence of steps. The procedure is general in scope and applicability. D. F. J.

1674. Mechanical Activation—A Newly Developed Chemical Process. M. C. Shaw. *J. appl. Mech.*, 1948, **15** (1), 37–44.—In the process of metal cutting, the metal at the point of cutting is subject to high temp, high pressure, and high stresses. These conditions will, in general, promote chemical reaction and it has been shown that the metal-cutting process may be employed in the preparation of organo-metallic compounds, the metal involved being cut in the presence of the reactants. This new technique may give to many versatile organo-metallic reactions a commercial significance which they have heretofore lacked because their application was limited to batch rather than continuous processes by the inflammability and toxicity of the reactants and the difficulty of starting and controlling the reaction.

The paper is well illustrated by photographs and graphs, and gives sixteen references. D. F. J.

1675. Analytical Treatment of Multicomponent Systems. L. A. Dahl. *J. Phys. & Colloid Chem.*, 1948, **52**, 698–729.—Intrinsic equations pertain only to composition and are not referred to co-ordinate axes or dimensions. They can, therefore, be applied to multicomponent systems without the necessity of thinking in terms of hyperspace. Specific applications discussed are conversion of compositions from one system of components to another, the classification of compositions with reference to the individual systems in which they lie, and the estimation of the proportions of phases at an invariant point. When defining a system within any given system, the number of equations increases as the number of components decreases in the system to be defined. Parametric equations, however, increase in complexity in the opposite direction to intrinsic equations and therefore may be used when the latter become inconvenient. The applications of parametric equations will be considered in a later paper. D. F. J.

1676. Permeability Studies. III. Surface Area Measurements of Carbon Blacks. J. C. Arnell and G. O. Henneberry. *Canad. J. Res.*, 1948, **26A**, 29–38.—The modified Kuzeny equation has been used to calculate the specific surface areas of several carbon blacks from measurements of permeability. The error is probably $\pm 10\%$. The method was compared with those of electron-microscope counting and of low-temp. N_2 isotherms. The permeability method is considered to be the most satisfactory, as it is quick and has about the same accuracy as the others. D. F. J.

1677. Electron Microscopy of Radiation Polymerization Products. J. H. L. Watson. *J. Phys. & Colloid Chem.*, 1948, **52**, 470–474 (*Symposium on Radiation Chemistry and Photochemistry, University of Notre Dame, Notre Dame, Indiana*, June 24–27, 1947).—The studies described are concerned mainly with the polymers of acetylene produced: (*a*) catalytically, (*b*) under alpha-ray bombardment, and (*c*) under corona discharge. It is observed that the alpha-ray polymers deposit as fairly large definite particles whose size and shape are recognizable, that the electron or corona polymers deposit as films possessing extremely fine structure, and that the catalytically grown polymers are formed as fibres whose appearance varies with the catalyst used. It is emphasized that polymers formed from the same source substance, but polymerized in different ways, are different materials and should be notated as such. D. F. J.

1678. Benzene Formation in the Radiochemical Polymerization of Acetylene. C. Rosenblum. *J. Phys. & Colloid Chem.*, 1948, **52**, 474–478 (*Symposium on Radiation Chemistry and Photochemistry, University of Notre Dame, Notre Dame, Indiana*, June 24–27, 1947).—In the radiochemical polymerization of acetylene it appears that benzene is produced simultaneously with the cuprene-like polymer, approx one-fifth of the reacting acetylene being utilized for benzene formation. These observations are incompatible with the ion-cluster theory of radiochemical reactions, and a mechanism based on a sequence of bimolecular reactions between a normal acetylene molecule and an excited molecule or polymer is proposed. It is suggested that benzene formation results from the cyclization of a linear trimer. D. F. J.

1679. Radiation Chemistry. IV. An Interpretation of the Effect of State on the Behaviour of some Organic Compounds and Solutions. M. Burton. *J. Phys. & Colloid Chem.*, 1948, **52**, 564–578 (*Symposium on Radiation Chemistry and Photochemistry, University of Notre Dame, Notre Dame, Indiana*, June 24–27, 1947).—A review is made of the processes occurrent in radiolysis of some organic compounds. The significance of the size of the bombarding particle, and the effect of the state of the medium on the primary process are considered. Attention is paid to hydrocarbons, and in particular to benzene, the low reactivity of which is in part attributable to its photochemical stability and in part to the stability of the $C_6H_6^+$ ion. Future experiments are suggested and twenty-six references given. D. F. J.

1680. Mass-Spectrometric Detection of Free Radicals. G. C. Eltenton. *J. Phys. & Colloid Chem.*, 1948, **52**, 463–469.—A summary of work described elsewhere (*J. Chem. Phys.*, 1947, **15**, 455–481. See Abstract No. 116, (1948)). D. F. J.

1681. Thermal Conductivity of Napalm–Gasoline Gels. G. O. Langstroth and F. Zeiler. *Canad. J. Res.*, 1948, **26A**, 50–59.—A modified form of Hutchinson's method for measurement of the thermal conductivity of liquids has been used to determine

the conductivity of napalim–gasoline gels. Convection effects were negligible. For temps, T, between −50° and 50° C and napalim concns., C, between 0 and 10 wt. % the conductivity, k, in cal/sec/cm/°C is described to better than 1% by $k \times 10^{-4} = 29{\cdot}7 - 0{\cdot}068T + 0{\cdot}11C$. The age of the gel does not appear to affect the conductivity.
D. F. J.

1682. Liquid–Vapour Equilibria for the Systems Water–Propargyl Alcohol and Benzene–Propargyl Alcohol. M. Simonetta and E. E. Mugnaini. *Chim. e Industria*, 1948, **30** (3), 73–78.—These systems were studied in considering the problem of extracting propargyl alcohol from its aqueous solutions. Some physical constants for the alcohol were also determined.
D. H. McL.

1683. Friction Factors. W. L. Nelson. *Oil Gas J.*, 22.7.48, **47** (12), 111.—Data are given for estimation of pressure drops through short lines in refineries, for liquids, including gasoline, water, kerosine, gas oil, light and medium lub. oils, at various temperatures.

A factor is given for surface conditions; and an example is provided and worked out.
G. A. C.

1684. Catalyst Manufacture—A Growing Industry. E. C. Ray. *Chem. Engng*, May 1948, **55** (5), 127–130.—The increasing role of ready-made catalysts in the chemical industry is reviewed. The history of catalysis is presented in tabulated form, from 1868 to the present time, to illustrate industrial progress in this field. Recent developments in the synthetic-rubber industry—particularly butadiene and styrene production—have been largely based on catalytic processes. The various types of catalytic material—powders, spheres, particles, tablets, pellets, and rings—are discussed, in addition to the new fluidized process for catalytic cracking. The major uses of catalysts in current demand in the petroleum, synthetic rubber, chemical, natural gas, and fat-processing industries are tabulated. The article concludes with a review of the various American catalyst-manufacturing companies, and a survey of the more important products.
R. T. W. H.

Analysis and Testing.

1685. Induction Period Calculator. E. L. Korb. *A.S.T.M. Bull.*, Aug. 1948, **153**, 99–102.—The A.S.T.M. Oxidation Stability Test for Gasoline suffers from the limitation that the determination and calculation of the induction period are subject to human error, and an induction-period calculator developed at the du Pont Chemicals Laboratory is described. The basic principles, operating details, limitations, and method of fabrication are described.
J. G. H.

1686. Apparatus for Determining the Sensitivity of Gas Detector Papers. A. S. Tulk, L. H. Cragg, and R. P. Graham. *Canad. J. Res.*, 1948, **26F**, 86–90.—The apparatus described is for the determination of the sensitivity of detector papers towards gases from liquids of low volatility. Papers may be moistened, dried, renewed, or replaced without disturbing the flow of gas through the rest of the apparatus.
D. F. J.

1687. Apparatus for Weighing in Vacuum. G. W. Monk. *J. appl. Phys.*, 1948, **19**, 485–486.—Can be used to weigh in vacuum (0·01 micron) at temps up to 700 °C.
D. F. J.

1688. Worker-Consistometer for Lubricating Greases. S. A. McKee and H. S. White. *A.S.T.M. Bull.*, Aug. 1948, **153**, 90–98.—A new apparatus, developed at the National Bureau of Standards from the Hain microworker, is described which combines the processes of mechanically working the grease and measuring its flow characteristics in the same series of operations. The apparatus comprises two coxial steel cylinders with a capillary-type shearing element located between them, the greases under test being forced through the shearing element from one cylinder to the other by means of closely fitting pistons. The shearing elements, made by drilling holes in circular steel discs ¼ in thick, cover a range of consistencies, having one, ten, and fifty holes respectively. Test data given show the effect of working upon the flow characteristics of greases and indicate that, with some greases, changes in the rate of working affect

the flow characteristics of the grease. Comparative data for this equipment and the regular A.S.T.M. worker are given, and advantages of the former are enumerated.

J. G. H.

Engine Fuels.

1689. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. Part III. Causes of the Effect of Metallic Dope to Delay Detonation. R. O. King. *Canad. J. Res.*, 1948, **26F**, 125–150.—The anti-knock effect of metallic dope is attributed to the catalytic action of the surface to oxidize the fuel in part to steam and CO_2, the consequent dilution of the end gas causing a reduction of inflammability sufficient to prevent completion of combustion in other than the normal manner. The surface is maintained in an oxidizing atmosphere by continuous deposition thereon of the metal of the dope, and experiments indicate that temps required for the necessary catalytic activity are attained during the period of flame travel; not prior to ignition. The evidence supporting this theory is: (*a*) steam is especially effective to reduce inflammability, (*b*) doped pentane or hexane oxidizes without ignition to steam and CO_2 only in reaction chamber no. 10 described in Part I (Abstract No. 1114 (1948)) at any temp of reaction, (*c*) the CO_2–steam reaction is inhibited by a sulphur catalyst poison, and the similar action in the engine destroys the anti-knock effect of the dope.

Experiments carried out with catalyst poisons: (*a*) showed that in conditions leading to high surface temps in the combustion space, a CO_2–steam reaction having a considerable anti-knock effect is obtained, and (*b*) produced conditions in which T.E.L. becomes a pro-knock.

The catalyst theory depends fundamentally on the oxidation of hydrocarbon fuel being a heterogeneous reaction as indicated by the experiments described in Part II (Abstract No. 1115 (1948)). Further evidence in support of this view is given in this part.

D. F. J.

1690. Oxidation, Ignition, and Detonation of Fuel Vapours and Gases. Part IV. Cause of Detonation or Combustion Knock in Engines. R. O. King. *Canad. J. Res.*, 1948, **26F**, 228–240.—A nuclear theory of self-ignition is described which is based on the substitution of finely divided carbon for the nuclear drops of the Callendar theory. The finely divided carbon appears in the gaseous combustible mixture in the engine as a result of pyrolysis of the lub. oil or of the fuel, and provides the distributed ignition centres required for detonation. The theory is complementary to the revised theory of surface oxidation developed in Parts I, II, and III, the occurrence or non-occurrence of detonation depending upon the result of a race between pyrolysis and a heterogeneous oxidation reaction. Confirmatory experiments will be described in succeeding parts.

D. F. J.

1691. Survey of Commercial Aviation Gasoline Characteristics July 1947 Production. W. C. Holliman, M. G. Barker, and N. Potts. *U.S. Bur. Mines Rep. Invest.* 4353, July 1948.—Inspection test data furnished by fifteen manufacturers on commercial grades of aviation gasoline are tabulated, together with special data obtained in the Bureau laboratories. Information is also provided in 80, 91/98, 100/130, and 115/145 grade aviation fuels.

G. S.

1692. National Motor-Gasoline Survey Winter 1947–48. O. C. Blade. *U.S. Bur. Mines Rep. Invest.* 4354, July 1948.—In this survey 3554 samples of motor-gasoline sold in 216 cities of the U.S.A. were examined. O.N. were higher than in the previous winter, averaging 79·4 for premium-price fuels and 75·3 for regular-price fuels. Reid vapour pressure averaged 10·1 lb for both grades, while distillation data differed little from the previous year. Details of all analyses are tabulated.

G. S.

1693. Ignition Qualities of Hydrocarbons in the Diesel-Fuel Boiling Range. A. D. Puckett and B. H. Caudle. *U.S. Bur. Mines Inf. Circ.* 7474, July 1948.—Present knowledge of the ignition qualities of pure hydrocarbons likely to be present in diesel fuels is summarized. The possible significance of cetane number and hydrocarbon structure is discussed. Cetane or cetene numbers and other physical properties of about 100 hydrocarbons are tabulated.

G. S.

Gas Oil and Fuel Oil.

1694. Economic Utilization of Fuel Oil in Boiler and Industrial Furnaces. A. Pearce. *I.P. Review*, Aug. 1948, **2**, 244.—Furnaces for oil firing in refineries have low combustion rates compared with those in other industries, usually not exceeding 10,000 B.Th.U/cu. ft/hr. The chief function of the industrial furnace is to produce a satisfactory product. Half a ton of oil gives same output from an open-hearth furnace as one ton of coal previously gasified in producers, with reduction in maintenance and operating costs. Hence oil will largely replace producer gas in the manufacture of steel.

Water cooling of walls and partial shrouding of tubes is desirable. If bare tube walls are retained, burners should be well clear of the tubes on all sides.

High-grade brick should be used in all furnaces burning oil or gas; refractories should contain a high percentage (over 40% Al_2O_3) of alumina.

A specification for such a brick is given. Open-hearth furnaces in South Wales converted to oil or tar burning have increased weekly output from 9000 to 11,000 tons, for example.

Future developments will be in increased use of oil and improvement of burner types. Operation costs of various types of burners vary with size of installation, fuel costs, and other considerations.

A figure gives an approximate comparison of the available heat from oil, fuel, and producer gas for different temperatures of gases leaving furnace, and another gives approximate temperatures to be attained with fuel, oil, and producer gas with excess air about 15%. G. A. C.

Lubricants.

1695. Effect of Detergent Additives on the Dispersing Properties of Oils. S. E. Krein, R. A. Lipshtein, and A. N. Aleksandrov. *Neft. Khoz.*, 1948 (6), 43–50.—A test method has been developed for measuring the detergency (dispersive power) of an oil by determining the time required for the settling from the oil of a weighed amount (0·4%) of soot of constant mesh. The test is accelerated by centrifuging and heating the oil. A repeatability of 10–15% is obtained. Tests on seven oils show that whilst the dispersivity of an individual oil is a function of the visc it varies for different oils (tested at the same visc) and that the soot particles do not follow Stoke's law. Oils contain natural anti-coagulating agents, these being more evident in residual oils than in distillates. An increase in the degree of refining decreases the dispersivity of an oil. Tests on additives indicated that naphthenates (in 1% concn) were very effective in the case of the Co soap and slightly in the case of Pb. Zn and Ba naphthenates had no effect. Trials with nine proprietary additives showed that, with the oils used, a Co-base product (Santolube 110) and a product based on S and P compounds of Zn (Lubrizol 738) were the most effective. The efficacy of additives decreased with increasing temp. Susceptibility of various oils differs to such an extent that an additive may increase the dispersivity of one oil whilst lowering that of another. V. B.

1696. Additive Motor Oils. Anon. *Petroleum*, July 1948, **11**, 159.—A recent paper presented to the American Society of Automobile Engineers by C. M. Larsen emphasizes that the new type motor oils classified as Premium or H.D. types will not overcome the inherent faults caused by fuels and engines.

Oxidation stability, bearing-corrosion preventive properties, and detergent characteristics are discussed. It is noted that excessive detergency tends to depreciate the anti-oxidant characteristics of the H.D. oils.

A curve is given showing the high detergency-dispersing properties of an H.D. oil using a basic alkaline type of detergent additive and a limited amount of anti-oxidant. This oil kept the engine clean, but the entire sludge and soot was so finely dispersed as to pass the filters. A better balance of the right kind and amount of detergency and oxidation inhibitor allows for clean engines and proper filtration. An extension of drain periods greatly increases the anti-oxidant requirements.

The effect of air–fuel ratio on piston lacquering is discussed. Very lean mixtures increase lacquer and lower the oil rating in the C.R.C., L.4. test.

In the case of a diesel fuel the end-point of the injection timing is critical in city bus operation, as under these conditions the engine runs too cool, resulting in incomplete combustion and causing the oil-control rings to sludge. Sulphur content in a diesel fuel has a varying effect, but a basic type of H.D. oil with a high sulphur (0·67%) diesel fuel checked well within the wear limits in tests on a Caterpillar engine.

The effects of blow-by gases and the need for crankcase ventilation are discussed. Cases have been cited where bus engines, with inadequate crankcase ventilation, have failed at 14,000 miles due to deposits in oil systems when using H.D. oils (2-103B type). Analyses are given of material scavenged from P.V. scavenger outlet-Taxicab service, showing the deadly character of the blow-by products of combustion and crankcase fumes due to high lead and ash contents and high acidity.

Data on improvements in compression pressures on using light detergent anti-oxidant, film-strength additive-type upper cylinder oil are given. F. W. H. M.

1697. The Load-Carrying Capacity of the Oil Film between Gear Teeth. E. M'Ewen. *Engineer*, 1948, **186**, 234–235.—A mathematical proof is given that the load-carrying capacity of the oil film between gear teeth, neglecting end leakage, is directly proportional to their relative radius of curvature, not, as is usually stated, the square root of this quantity. The equation derived is $P = 3{\cdot}924\ \mu vr/h_0$, where P is total load-carrying capacity per unit width, μ oil viscosity, v relative velocity, r relative radius of curvature, h_0 minimum film thickness. An empirical index of 0·8 is applied to the relative radius in calculations, probably necessary on account of the unsatisfactory nature of the "speed factor," which is based on r.p.m. only and does not allow for pitchline speeds being different at the same cyclic velocity. A. C.

1698. Some Vibration Aspects of Lubrication. A. C. Hagg. *Lubrication Engineering*, Aug. 1948, **4**, 166–169.—The influence of bearings on the vibration characteristics of machinery and the modifications of that influence by lubrication are discussed. The effects of the damping and elastic properties of oil films in limiting the vibration of rotating machines are described, together with the occurrence and elimination of oil-whip and the confusion of this with sub-harmonic resonance. J. G. H.

1699. Protection of Ball and Roller Bearings in Service. H. D. Birdsey. *Mech. World*, 17.9.48, **124**, 313.—The tolerances allowable during manufacture of ball and roller bearings are small, but this care is unavailing if the user does not supply adequate means for their protection during service. Sealing devices of various designs are on the market for this purpose. The best known of these are the pad seal (the simplest of all), the external flinger seal, the labyrinth seal (for high-speed work), and the piston-ring seal. Bearings with self-contained shields or seals are also available. O. M.

Bitumen, Asphalt, and Tar.

1700. Dependence of the Rheological Properties of Asphaltic Bitumen on its Composition. R. N. J. Saal. *Ingenieur*, 3.9.48 (36), M59–51.—Four main types of bitumen are possible: (1) without elasticity and thixotropy; (2) with elasticity and without thixotropy; (3) with elasticity and with thixotropy; (4) without elasticity and with thixotropy.

The rheological property of an asphaltic bitumen of a given asphaltene content is determined by the C–H ratio of the maltenes and asphaltenes. At high C–H ratios of the two fractions the bitumen behaves as a Newtonian liquid, at moderate C–H ratios the bitumen shows elasticity.

If the C–H ratio of the maltenes is high, the bitumen behaves almost as a normal liquid, whereas if the C–H ratio of the maltenes is low, thixotropy is being established due to the formation of a gel-like structure. N. C.

Special Hydrocarbon Products.

1701. Butyl Alcohols. Anon. *Chem. Engng*, May 1948, **55** (5), 344.—The production, consumption, and uses of the butanols are surveyed. R. T. W. H.

Coal, Shale, and Peat.

1702. Oil Shale Mining. T. Ertl. *Petrol. Tech.*, May 1948, **11** (3); *A.I.M.M.E. Tech. Pub. No.* 2359, 1–8.—Oil shale is a sedimentary rock containing solid substances of indefinite composition and known as kerogen. On heating, the latter is decomposed and yields gases and shale oil, with other substances. Some shales yield as much as 160 gal/ton and immense deposits give 10–15 gal oil/ton.

The richest and most extensive oil-shale deposits known in U.S.A. are in western Colorado. A section near Rifle appears most suitable for commercial exploitation by mining. The surface development at this place is described. Two areas are being mined. At one there is selective extraction of various parts of a 70-ft oil-shale bed; at the other the same bed is being mined by underground quarry methods to demonstrate low-cost oil-shale mining methods. Descriptions are given of both these operations. There will be extensive mechanization in the second project. Two miners will be able to drill enough holes to break over 1000 tons of rock per shift. Mechanical shovels and loaders will handle this in a single shift. In both projects research will be carried on to develop new and improved practices for mining oil shale.

G. D. H.

1703. Oil-shale Processing. J. D. Lankford and B. Guthrie. *Petrol. Tech.*, May 1948, **11** (3); *A.I.M.M.E. Tech. Pub. No.* 2360, 1–12.—The Bureau of Mines Oil-shale Demonstration Plant programme has almost reached the end of the initial construction phase. At Rifle, Colorado, two 40-ton N.T.U. oil-shale retorts and the crushing plant are in operation, two pilot-plant retorts will soon be operating, and a plant-scale refinery (200 b.d.) is under construction. The above are described in some detail. The refinery incorporates several types of thermal operation, three-stage, low-temperature acid treating, doctor sweetening, and re-running.

Data are given on typical N.T.U. retort runs. Yields of 90–100% of assay values were obtained on 30 gal/ton shale in a retort cycle time of 18 hr. Mid-Continent crude and N.T.U. shale oil are compared: the shale oil has a high pour-point, low A.P.I. gravity, about 0·8% sulphur and 2% nitrogen; the naphtha fraction has 3% tar acids, 9% tar bases, and 50% olefines.

The problems involved in refining shale oil into usable products are discussed in detail.

G. D. H.

1704. Oil from Shale. Anon. *World Petrol.*, 1948, **19** (9), 49–51.—A description of the mining and pilot-plant processing of Colorado shale, for the production of gasoline. Cost estimates are compared with those for gasoline from crude oil, natural gas and coal.

E. B.

1705. Shale Oil in Sweden. H. E. Linden. *Producers' Monthly*, July 1948, **12** (9), 29.—Shale oil is produced by crushing and retorting to remove volatiles. Ash or coke is discharged and the gases cooled to obtain oil by condensation. The Swedish plant consists of three Bergh ovens total capacity 1750 tons/day, two Industrimetoder ovens, 1200 tons/day and one Rockesholm oven 500 tons/day. The shale is crushed, screened to requisite particle sizes, and stored in silos of dia 29 ft 6 in and height 57 ft 9 in.

A method for extracting shale oil *in situ* by electrical heating is described, and results are stated to be fairly satisfactory.

Prices at which the products are sold are mentioned and also the uses and approximate quantities of the many by-products.

C. G. W.

Miscellaneous Products.

1706. Water-Mixtures as Grinding and Cutting Fluids. W. H. Oldacre. *Lubrication Engineering*, Aug. 1948, **4**, 162–165, 186.—The constitution and functions of cutting fluids of the water-mixture type are described, the effects of water contaminants considered, and the necessity for testing is stressed. Tests described comprise stability tests, chemical analysis, rusting, wetting-out characteristics, and foaming tests.

J. G. H.

1707. Aluminium Soaps as High Polymers. H. Sheffer. *Canad. J. Res.*, 1948, **26B**, 481–498.—Viscosity and osmotic-pressure measurements were carried out on dilute

(0·025–1·0%) benzene solutions of aluminium dicaprylate, dilaurate, dimyristate, dipalmitate, distearate, and monostearate. It is concluded that these soaps are polymers bound by weak intermolecular links. Breaking of these links lowers the mol. wt. and causes a lower solution viscosity, and is due mainly to the effect of concn and ageing. The soaps were prepared from the corresponding fatty acids by metathesis of the potassium soap in aqueous solution with aluminium chloride. It is postulated that the intermolecular links are formed during the precipitation of the soap, and as it is difficult to duplicate exactly the conditions of preparation, the mol. wt. and thickening powers of the soaps vary from batch to batch. D. F. J.

Engines and Automotive Equipment.

1708. Apollo. Anon. *Flight*, 26.8.48, **54**, 235.—This is the first post-war civil aircraft by Armstrong-Whitworth and is powered by four Mamba II air-screw turbines. A cutaway drawing is given of the engine installation together with performance data. I. G. B.

1709. Review of British Aircraft Industry. Anon. *Aeroplane*, 3.9.48, **75**, 289.—On the occasion of S.B.A.C.'s annual display, the *Aeroplane* has produced a supplement giving details of the products on show. These are in form of tables of engines, airframes, and cutaway drawings. I. G. B.

1710. S.B.A.C. Display. Anon. *Flight*, 16.9.48, **54**, 339.—Further details are given of aircraft, engines, and gas-turbine developments at this show. I. G. B.

1711. Trends in Reciprocating Engines. E. Eltham. *World Petrol.*, 1948, **19** (9), 42–43.—A discussion of refinements which may be expected in conventional aero-engines, with special reference to utilizing energy from exhaust by means of a turbine. E. B.

1712. Notes on Heavy-Duty Diesel Engine Bearings. L. M. Tickvinsky. *Lubrication Engineering*, Aug. 1948, **4**, 170–174.—The value of wartime operating conditions in the development of bearing materials, lub. oils, and operating and maintenance schedules is outlined, while the performance of power bearings and dynamically loaded bearings is discussed. The selection of bearing materials in relation to performance requirements is considered, and the advantages of centrifugally cast bronze bearing shells in bearings subjected to severe cyclic loading are enumerated. J. G. H.

1713. Economics of Gas-Diesel Engines. R. A. Darling. *World Oil*, Feb. 1948, **127** (10), 174.—Some of the more important advantages of gas-diesel engines are described, and comparative cost curves are presented. R. B. S.

1714. Ten with Turbines. Anon. *Flight*, 2.9.48, **54**, 263.—Photographs are given of an imposing array of British aircraft operating with gas turbines and a brief history of their development and performance. I. G. B.

1715. Power Plant Production in Sweden. Anon. *Flight*, 19.8.48, **54**, 216.—A survey is given of the Svenska Flygmotor AB, Lysholm, gas-turbine designs and Goblin manufacture under licence. I. G. B.

1716. Power for the Giants. Anon. *Flight*, 5.8.48, **54**, 153.—A preliminary description of the application of the Bristol Proteus turbo-prop unit to the Brabazon and S.R.45 aircraft is given. A cutaway drawing of the unit is shown and leading particulars are as follows: overall length, 99·75 in; net weight, 2900 lb; overall diameter, 38·5 in; compressor r.p.m., 10,000; sea-level static power, 3200 h.p. + 800 lb jet thrust. I. G. B.

1717. Thermodynamic Properties of Combustion Gases. J. Kestin. *Aire. Engng*, Aug. 1948, **20**, 236.—A simplified basis is given for the calculations of gas-turbine efficiencies in which all the variables are related to the properties of air by means of determined constants. These constants are tabulated in the form of C_p, C_v, and γ varying with temperature and air–fuel ratio for a standard fuel. Auxiliary tables are

given of the thermodynamic properties of the theoretical combustion gas from motor benzol, diesel oil, and ethyl alcohol. I. G. B.

1718. New Single-Plunger Pump for Small Oil Engines. Anon. *Auto. Engr*, Aug. 1948, **38**, 315.—A simple, low-cost, easily serviced fuel-injection pump has recently been announced by the American Bosch Corporation. The pump is driven at crankshaft speed on four-stroke-cycle engines and is of the cam-actuated, constant stroke, throttled-intake type.

A very detailed description of its mechanism is included. O. M.

MISCELLANEOUS.

1719. A Viewpoint on Petroleum Engineering Education. J. H. Kaveler. *Petrol. Tech.*, May 1948, **11** (3); *A.I.M.M.E. Tech. Pub. No.* 2382, 1–13.—Education aims at developing citizenship, and when also intended as a preparation for a career in engineering must provide a background of basic science, inculcate an aptitude for applying that knowledge practically, and provide an understanding of the industrial art in which the engineer will be engaged. The process of education must extend from the classroom into industry. Specialization within engineering should take place as a result of experience in industry; if it is attempted in the university there will be some sacrifice of the essentials of formal education.

In addition to scientific ability and a capacity for applying science, the engineer needs personal qualities which include the capacity to write and speak in an understandable manner, the ability to work as part of a team, to gain experience in working, and to undertake responsibility. Proper leadership by instructors is of value in this connexion. G. D. H.

1720. Design of Unit Operation Laboratories. W. C. Kranich. *Chem. Eng. News*, 1948, **26**, 1830–1832.—The practices in laboratory-building design and layout for the study of unit operations in chemical engineering in some twenty-five institutions in the U.S. and Canada are reviewed under the headings of general dimensions, balconies, cranes, walls and floors, illumination, drainage, services, and auxiliary facilities.

E. S. E.

1721. Oil in the U.S.A. (2). Anon. *Petroleum*, Feb. 1948, **11**, 39.—Improvements in control and recording instruments for use in refinery operations have been made by the introduction of electronic principles.

Research methods now include the use of the electron microscope, X-ray and electron diffraction, infra-red, ultra-violet and Raman spectroscopy, and mass spectrometry.

Much attention is being given to catalysis and catalytic processes.

The " Thermofor " cracking process has recently been improved to provide a mixed-phase technique which permits catalytic cracking of partially vaporized oils. Cracking operations using " fluid " catalyst are described.

Major oil companies are installing over $500 million worth of new refining equipment. A present trend is towards construction of units which enable refineries with plants of moderate capacity to meet competition in high-test motor fuels.

More than fifty new major refining units are known to be under way. Details are given of developments of interest in these projects.

Plant is under construction to provide a hydrocarbon synthesis gas from natural gas and oxygen.

Also discussed are improvements in distribution, including pipeline capacity, packaging of products, and storage methods. F. W. H. M.

1722. Visual Control System. L. S. McCaslin, Jr. *Oil Gas J.*, 19.8.48, **47** (16), 109–112.—Produc-trol is a system which analyses routine paper records in a visual manner, so providing an overall picture of operations.

The Produc-trol board has seven major components: (1) permanent card records, including a visible index; (2) peg-hole section; (3) signal pegs, used to indicate " quantity " or " time " values, inserted in the peg-holes, and making it possible to analyse visually the information on the permanent card records; (4) progress tape

pegs, fastened to the end of progress cards to hold them on the board at the desired places; (5) today line, a vertical cord which moves across the board to indicate the current date; (6) heading strip, a replaceable card calibrated in "time" and "quantity" values, and scaled off to indicate desired values for signal pegs; (7) legend card, to show the colour and shape of the signal pegs being used, and what they represent.

The system is being used by nineteen oil companies, in drilling, producing, and refinery maintenance. W. M. H.

1723. Composition of Aluminium Stearate. W. Gallay and I. E. Puddington. *Canad. J. Res.*, 1948, **26B**, 155–160.—It was found that the composition of aluminium stearate as normally prepared approximates to that of the distearate. Extraction over long periods, however, reduced the proportion of stearic acid to that of a monobasic soap. When water was not carefully excluded, stearic acid was extracted far beyond the theoretical for the monostearate, indicating that small quantities of water hydrolyse the monostearate to a complex binary of aluminium hydroxide and stearic acid. The results obtained by solvent extraction were corroborated by indicator titration and electrometric titration experiments. D. F. J.

1724. Some Unique Properties of Sodium and Potassium. H. N. Gilbert. *Chem. Eng. News*, 1948, **26**, 2604–2606, 2660.—A solution of sodium hydride in fused caustic soda is being used commercially for removing oxide scale from metals. The process is unsatisfactory for descaling aluminium and magnesium. E. S. E.

BOOK REVIEWS.

Distillation and Rectification. E. Kirschbaum. Translated by M. Wulfinghoff. New York: Chemical Publishing Co. Inc. 1948. Pp. 430. $10.00.

The reviewing of this book involves the twofold task of assessing the merits of the work itself and the merits of the translation. A longer interval than usual has elapsed between the publication of the original German edition and the publication of this translation, probably as a result of war conditions. The original German edition was published in 1940 and became generally available outside Germany in 1943, when it was reproduced in the U.S.A. by authority of the Alien Property Custodian. Thus five years have elapsed since the German version became generally available, and eight years since it was originally published. It is most surprising that this translation contains no indication of the original date of publication. The author's preface to the original version bears the date "November, 1939." Although the translation also contains this preface, the date is most regrettably omitted. At the end of the book is a "Review made by the translator of progress made since the original publication." This is little more than a scrappy collection of literature abstracts covering 16 pages, of which 4 pages are devoted to a method of plotting vapour-pressure data and another 5½ pages to illustrations. This review contains only one reference (from an Argentinian journal) to literature published outside the U.S.A., and it adds little, if anything, to the value of the book, except that it might be useful in directing the reader's attention to the fact that a considerable interval of time must have elapsed between the publication of the original work and the publication of the translation.

Of the work of the translator it must be said that it is a very poor performance. Quite apart from the infelicity of his style, which produces phrases such as (p. 193) "the reflux condenser is so hooked up that it will have an enriching action," there are numerous errors and mistranslations which will undoubtedly cause trouble and difficulty to many readers. Owing to limitations of space, only a few examples can be quoted here. Thus, on p. 46, we find "the boiling-point and dewpoint curves of carbon dioxide–sulfur dioxide mixtures are considered for pressures of 41·3 and 93 atmospheres absolute." Here "are considered" is the alleged translation of "in Bild 31 . . . wiedergegeben," which means "shown in Figure 31." The omission of the reference to Figure 31 renders half a page of text meaningless. Also on p. 46 we find "points located within the area confirmed by the boiling-point and dewpoint curves." Here "confirmed" represents "eingeschlossenen," meaning "enclosed." At times the translator seems to be most unwilling to accept a single English word as a translation of a single German word. Thus on pp. 40 and 41, "Destillationsfeld" is translated as "distillation area" in the section headings and as "distillation region" in the text following. On pp. 48–51, within the space of four sentences, "Destillationsdruck" becomes "distilling pressure," then "distillation pressure," then "pressure distillation." On p. 255 "Verstärkungsverhätnis" is translated as "rectification ratio" in the sub-heading and as "enrichment ratio" in the text following. A noteworthy example of this practice of the translator of taking several shots at the target, in the hope that one of them will hit it appears on pp. 73 and 74, where "Blasenfüllung" is in succession translated as "batch-capacity," "still-capacity," and "batch charge." It almost destroys one's faith in the laws of probability to find the translator making so many attempts without ever arriving at the correct translation, namely, "still charge." In the section on molecular distillation there appears on p. 350 "The liquid to be decomposed," referring to the feed to a molecular still, and on p. 351 "A unit of the type shown in Figure 227 serves to decompose a liquid into two components." Both "zerlegen" and "trennen," which mean "to split up" and "to separate" respectively, are translated as "to decompose." This will be particularly bewildering to many readers as it follows very shortly after the statement "By means of molecular distillation it is possible to distil liquids which would decompose under the temperatures and conditions usual in distillation." Here "decompose" is the correct translation of "zersetzen." On p. 321 also we find "If it is desired to use a batch still with a packed column to decompose a binary mixture . . ."

The carelessness in translation is matched by carelessness in other details. In the

German edition the literature references appear as footnotes in the text. In the translation these references are collected together into a bibliography at the end of the book, but no reference to this bibliography appears in the Table of Contents at the beginning of the book. Several minor errors in the German edition have been magnified in the translation. Thus, in a reference to a paper by Clark S. Robinson, the German edition gives the author as "Clark, S. Robinson," and the translation simply gives "Clark." Similarly, for a paper by Claude C. Peavy and Edwin M. Baker, the German edition gives "Claude, C. Peavy and E. M. Baker" and the translation converts this to "Claude, Peavy and Baker." One matter for comment —and here the author and publishers of the German edition certainly bear no responsibility—is the reference in the translator's "Acknowledgements" in the English edition to the University of Knoxville, Kentucky. This reviewer makes no claim to a profound knowledge of the geography of the United States, but he would suggest that the translator and editor of the English edition ought to undertake a systematic tour of Kentucky to ascertain whereabouts in that State the University of Knoxville is located.

Leaving aside the question of the translation, Kirschbaum's book is undoubtedly a valuable contribution to literature on distillation. Binary mixtures are treated in detail, and the use of enthalphy-concentration diagrams is discussed at some length, though it is surprising that no mention is made of Ponchon and Savarit, who pioneered and developed the use of these diagrams in distillation problems. Multicomponent mixtures are dealt with in less detail and, in particular, the discussion of minimum reflux ratio is inadequate. There are valuable sections on plate efficiency and packed columns, which incorporate the considerable experimental work carried out by the author. The author's method for determining the height of a packed column, which is based on heat transfer between vapour and liquid, is presented in detail, but it can hardly be regarded as having a substantial foundation on actual experiment. Some minor sections of the book might just as well have been omitted. Thus the section on "Control equipment" consists of 1½ pages, and the only type of control apparatus mentioned is a steam regulator of the Savalle type which dates back into the last century. It is unfortunate that the system of notation used in the German edition and also in the English translation differs from that which is generally used. For example, F and D are used for the amounts of liquid and vapour respectively ("Flüssigkeit" and "Dampf"), while these symbols are generally used to refer to feed and distillate. A. J. V. U.

Rotary Drilling Handbook. J. E. Brantly. 4th Edition. Los Angeles, New York and London: Palmer Publications. 1948. P. 568. $7.50 (37*s.* 6*d.*).

As the author states in his preface, this handbook is designed to give within its covers all that material and all those tables that are ordinarily required by the field engineer or practical rig operator.

This it undoubtedly succeeds in doing, with great clarity and with a brevity which permits the subject matter to be comprised in a volume of handbook dimensions. The most modern trends and practices are covered, and a particularly welcome portion of the introductory chapter defines clearly the place and function of the drilling department in the oil-producing industry. Another very valuable chapter is devoted to safety measures concerned with drilling.

An interesting summary chapter is included in which the prerequisites of modern heavy-duty rotary drilling rigs are listed.

Throughout, the emphasis is on heavy equipment, and more information might perhaps have been given on rig sizes for various depths. Data on weights of the rig components would also be of value, as so often it is the weight of the rig parts—particularly pumps—which determines what can be used in the foreign field. The author has not covered the subject of marine and other off-shore drilling, the methods and economics of which are absorbing great attention currently.

The section devoted to tables and formulas cleverly avoids unnecessary detail, and thus permits clearly readable data which, however, are amply sufficient for the use of the field operative.

Summarizing, it may be said that this book is the work of an expert, written expressly for practical men of the drilling departments of the oil industry.

E. C. S.

The British Fuel and Power Industries. London: Political and Economic Planning Organization. 1947. Pp. 400 + index. 30*s*.

This comprehensive report carries on the tradition of industry surveys established by the study groups working under the PEP (Political and Economic Planning) Organization.

As is to be expected of a publication covering British fuel and power industries, it deals mainly with coal, but the particular role of petroleum is well taken care of.

Indigenous crude-oil production not being promising, the main items of interest from the petroleum angle are the manufacture of liquid fuels from coal, and the opportunities of refining foreign crude oil in the U.K.

The report confirms that, from the availability and cost point of view, little could be expected from making liquid fuel from coal. As to the refining of imported crude, the report gives a comprehensive, if not quite up-to-date, list of existing installations, and provides a general review of the pre-war and post-war thinking on the justification of building refineries in a consumer country like the U.K. This problem is discussed in its relation to possible savings of foreign exchange and to the training of chemical engineers. Reference is also made to the availability of chemical raw materials based on petroleum, which depend on refining activities in the U.K.

Finally, the report deals with the fuel requirements of the several consuming industries. The more recent developments in respect of conversion from coal to oil, its prospects and limitations, are not specifically mentioned, as they apparently took place after the conclusion of the report.

On the whole, this PEP report is one more very useful work of reference, although it inevitably suffers from having been compiled by a number of people, and is therefore, like all similar composite efforts, lacking in a comprehensive conception of the essential problems involved.

P. H. F.

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Oilfield Exploration and Exploitation.

Geology.

1725. The Geologist in Uniform: World War II. D. M. Delo. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1691–1711.—A study has been made of the utilization of scientists and engineers in the U.S. Armed Forces during the recent war. 3142 replies were received to some 7000 questionnaires circulated by the American Association of Petroleum Geologists and the Geological Society of America. They showed that 614 geologists reported military service in the war, and about half of these reported some technical utilization of their training whilst in uniform.

The probable reasons for the incomplete technical utilization of geologists in uniform are given. Responsibility for the application of modern geologic techniques to military problems is equally the function of organized geology and the Armed Services. A programme of continual liaison between organized geology and the Services is therefore shown to be clearly necessary. E. N. T.

1726. Surface Geology Beneath the Sea. J. L. Chase. *Petr. Engr*, Aug. 1948, **19** (12), 102.—Geologic studies of the sea bottom assist planning of exploration operations in the open sea. Such studies involve soundings and samplings, and recently a method of taking oriented cores has been devised. The core barrel consists of thin-wall tubing ground to a sharp cutting edge. Coring is effected by means of an air hammer simulating a pile-driver effect. The drill string is oriented by sight vanes to points on shore of known bearing. Orientation is correct to 5°. Details of equipment and procedure are described. C. G. W.

1727. Gas for the Future. G. F. Moulton. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1808–1820.—The growth of natural gas sales has been one of the outstanding industrial developments in the U.S.A. in the past twenty-five years. Pipeline projects approved by the Federal Power Commission indicate a sharp increase in the use of natural gas in the immediate future. To maintain gas reserves, important additional reserves will consequently have to be discovered.

The large sedimentary basins are the loci of geological conditions necessary for important accumulations of oil and gas. The status of exploration and prospects for further discoveries of thirty-three important basin areas in the U.S.A. are briefly discussed. On the basis of available data, of those basins which are adequately explored, the Anadarko, Midland, and Gulf embayments offer the greatest promise of discovery of substantial gas reserves. Of these, the Gulf embayment, defined as including the area from beyond the Rio Grande to the east side of the Mississippi delta and including the " tidelands " area, is believed to have the greatest prospects. E. N. T.

1728. California Sees Oil Prospects in New Areas. Anon. *Oil Gas J.*, 9.9.48, **47** (19), 133.—Late in 1947 12° oil was discovered at San Ardo in the Salinas Valley. Initially the wells averaged about 65 b.d. Better wells were obtained to the north. The Cuyama Valley wells are larger producers.

Oil has been found offshore in the Elwood, Capitan, and Goleta fields. These indicate that oil accumulations may extend well out to sea, and the area offshore from Santa Barbara County looks most favourable. G. D. H.

1729. Exploration in the Dakota Basin. J. P. Gries. *World Oil*, June 1948, **128** (2), 121.—The Dakota basin consists of a central part, the Williston Basin, the Lemmon syncline, and the Moosejaw syncline. Seeps have long been known on the west flank

of the Black Hills and these aroused interest in the oil possibilities of the Dakota basin. Sharp anticlines on the north, south, and east flanks of the Black Hills were tested mainly by shallow wells. About twenty tests were drilled in the deeper parts of the basin, only a few being based on sound surface mapping. Up to 1938–39 only five had gone below the Dakota sandstone. Extensive leasing followed this period, and geophysical and geological parties operated over most of the unglaciated or slightly glaciated parts. Disappointing results from a few tests caused the dropping of much acreage.

Kamp 1, drilled in north Dakota in 1937–38, went to 10,281 ft, and found 4000 ft of pre-Permian beds. Later drilling confirmed the wide extent of these old beds, which are assigned to the Ordovician, Devonian, and Upper Mississippian.

Anticlines are known, and some have been tested. There is also the possibility of pinch-outs on the pre-Cambrian land mass which forms much of the eastern edge of the basin. Other pinch-outs are possible elsewhere in the basin. Drilling has taken place on the Nesson anticline, shows being noted. On the southeast extension of the Cedar Creek anticline, tests have had good oil shows in the Mississippian, Devonian, and Ordovician. The evidence suggests pinch-outs east of the Missouri river in glaciated areas. Ordovician shows were met in a test on the Camp Crook anticline. In central South Dakota the Upper Cretaceous has given gas in shallow wells, and the Butte test in Stanley county found dead oil in the Pennsylvanian.

South of the Black Hills, which is strictly not in the Dakota basin, a number of tests have been drilled. Some gave a little gas in the Cretaceous, and one found good oil saturation in the Morrison. No encouraging results were found in tests of the Chadron arch.

The main hopes appear to lie in Paleozoic stratigraphic traps. G. D. H.

1730. Structural Trends and Fault Systems in Eastern Interior Basin. S. K. Clark and J. S. Royds. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1728–1749.—The Eastern Interior Basin is a structural basin between the Ozark uplift and the Cincinnati–Nashville dome uplift. The two most conspicuous structural features are the La Salle anticline and the lobe of the basin in Kentucky. The area acquired its basin character at an early age and retained it throughout most of geological history.

Within the basin there are two different types of structure. The first consists of a series of diagonal shear faults trending S.20° W. and paralleling lines of anticlinal folding. The other is the Shawneetown–Rough Creek fault zone and associated faults extending across the south end of the basin.

On the basis of the evidence presented, the writers suggest a new explanation and classification of the latter zone of faulting. E. N. T.

1731. Geology of West Tepetate Oilfield, Jefferson Davis Parish, Louisiana. F. W. Bates and J. B. Wharton, Jr. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1712–1727.—The West Tepetate oilfield, in the Louisiana Gulf Coast area, was discovered in 1944. The presence of the structure was first suggested in 1930 by torsion-balance exploration and was subsequently confirmed by seismographic surveys. The producing section lies below the *Heterostegina* zone in the Middle Miocene, and consists of twelve oil- and gas-bearing sands ranging from 7600 to 9900 ft in depth. The structure is a gentle, irregularly elongate dome, apparently produced by the deep-seated intrusion of salt. The productive limits of the field so far established enclose an area of 1400 acres, comprising an estimated reserve of 30–40 million brl of liquid hydrocarbons, and 60–70 billion cu. ft. of gas. E. N. T.

1732. Stratigraphic Relations of Certain Jurassic Formations in Eastern Mexico. R. W. Imlay, E. Cepeda, M. Alvarez, and T. Diaz. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1750–1761.—The Jurassic formations of Mexico are defined, and their probable correlation and origin discussed. E. N. T.

1733. Buried Topography, Initial Structures, and Sedimentation in Santa Rosalia Area, Baja California, Mexico. I. F. Wilson. *Bull. Amer. Ass. Petrol. Geol.*, 1948, **32**, 1762–1807.—The geologic history of the west side of the Gulf of California is well recorded near Santa Rosalia, Baja California, Mexico. During Miocene times a thick

accumulation of volcanic rocks (Comondú volcanics) grading westward into terrestrial sediments, was derived from the present site of the Gulf. These rocks were gently tilted westward over most of the peninsula, but were locally strongly deformed by faulting near the Gulf. When the first engulfment by the sea occurred in early Pliocene time, the topography of the Comondú surface was still in a stage of late youth or early maturity. The depositions of Pliocene and Pleistocene sediments over this youthful topography resulted in prominent initial structures. The initial structures have been modified by tilting and normal faulting occurring at various times. The conditions of sedimentation and the origin of the initial structures is discussed, and the literature is reviewed concerning initial structures described in other regions.

E. N. T.

1734. Oil Development in Colombia Needs New Incentives. E. Ospina-Racines. *World Petrol.*, Sept. 1948, **19** (10), 76.—From 1931 to mid-1948 537 oil-concession applications were submitted to the Colombian Government. In the same period major operators made about 850 leases covering about a million hectares of oil land. The concession applications represented about 20 million hectares of original prospective oil territory. The granting of concessions is a slow process, and now four to five years may elapse between the application and the granting of the concession. This and other factors have restricted wildcatting.

Of the 537 concession applications only sixty-six have been granted, and forty-six of these have been surrendered. Wildcatting has taken place on seven private properties, but two have been abandoned. Since 1935 there has been wildcatting on forty concessions. Wildcatting before 1931 yielded the Infantas, La Cira, Rio de Oro, and Las Monas discoveries, only the first two proving commercial. Later discoveries were made on the Yondo, Dificil, and Cantagallo concessions. In all thirteen fields have been found. Currently the output is 65,754 b.d. with an addition of 3000 b.d. expected when Dificil shipments start.

Tables give data on concession applications, etc., on the fields and on wildcats.

G. D. H.

1735. Behaviour of Riverine-Marine Muds with Respect to Oxygen Dissolved in the External Environment. C. Francis-Boeuf. *Rev. Inst. franç. Pétrole*, 1948, **3**, 119–133.—Investigations were made on muds drawn from the Penzé estuary (Northwest France) at half-tide during August. Numerous analyses showing O_2 content are given, the special conditions in an estuary (as distinct from the open sea) lead to the development of a superficial layer round such muds, this layer has an inner aqueous phase containing 3–4 cc of O_2 per l. Numerous laboratory tests on mud samples show that this layer exhibits both photosynthetic O_2 evolution and respiratory O_2 absorption. Experiments were made on the biochemical O_2 demand of muds stored *in vitro* with sea water. It is concluded that, under normal conditions, intertidal riverine muds, although having a potential O_2 demand, cannot, owing to the protective superficial layer, make use of available O_2 in the surrounding water. V. B.

1736. Turkey Plans Vast Drilling Programme. Anon. *World Oil*, June 1948, **128** (2), 228.—A well on the Ramandag anticline is reported to be swabbing about 500 b.d. of 15° oil from 4400 ft. A well in 1940 flowed 70 b.d., but soon went to water. Other wells had small oil outputs. Further drilling is planned. G. D. H.

1737. International News. Anon. *World Oil*, June 1948, **128** (2), 241.—Geological and geophysical work is being continued in the Great Artesian Basin area of Australia.

An 8000-ft well has been abandoned on the Oliana anticline in Spain.

Asl 1, 10 miles south of Sudr in Sinai, has been completed for 600 b.d. at 3872 ft.

2 miles west of the Hahot oilfield in Hungary the Hahot–Ederics gas field has been opened. Production is from the Lower Pliocene. No outlet is available, but the initial potential of the nine wells is about 27 million cu. ft./day. The producing depth is 4592–4920 ft.

Substantial oil showings are reported at 2400 ft in a well near Beziers, France. Near Lake Annecy an oil sand is said to have been met in a well at a depth of 1100 ft.

G. D. H.

Geophysics and Geochemical Prospecting.

1738. Granite Wash or Solid Granite? C. J. Deegan. *Oil Gas J.*, 2.9.48, **47** (18), 84.—In certain areas there is the possibility of wells passing through granite wash before entering granite, and it is important to know which of these is being penetrated, because there may be oil prospects in the former. Cuttings and drilling rates offer no clear solution to this problem, but it has been found that the cuttings from the granite wash differ significantly in magnetic properties from those from the solid granite. The properties are magnetic susceptibility and remanent magnetism. The magnetic susceptibility is higher for the solid granite than for the granite wash.

G. D. H.

Drilling.

1739. Construction of Cable Tool Bit Forges. F. J. Spang. *Petrol. Engr*, Aug. 1948, **19** (12), 55.—The heat treatment of steel for forging and hardening is of paramount importance. If the steel is heated with an excess of air there is a tendency for decarbonization and oxidation of the steel. Excess air also tends to give a hot flame which overheats and may burn the surface of the steel before the body of the bit is heated. In the case of liquid and gaseous fuels, the fuel–air mixture must be thoroughly mixed, and a slight excess of fuel used. With solid fuels excess fuel should be charged initially or more fuel added during heating. Practical details for constructing a forge for bits up to 8-in dia are given, illustrated with numerous diagrams. C. G. W.

1740. Offshore Drilling Methods and Production Problems. G. B. Parks. *Petrol. Engr*, Aug. 1948, **19** (12), 90.—The only drilling methods used in the Gulf of Mexico are: (1) the piling platform; (2) combination piling platform and floating barge. The latter involves more risk than the large platform alone, but where reasonable risk is assured its economy makes it desirable.

Principal production problems involve storage of oil and transportation of oil from well-head to inside storage or market. C. G. W.

1741. Electrical Logging Developments in the U.S.S.R. Part 5. Interpretation of Resistivity Data by Partial Curve Matching. H. Guyod. *World Oil*, June 1948, **128** (2), 92.—Practical charts for curve-matching do not seem feasible when three variables are involved. In surface electrical work, simplification of three-medium to two-medium curves is reasonable for determining the resistivity of the top medium. A comparable condition exists in electrical logging, and when long spacings are used the conventional three-medium distribution of a mud-invaded bed can be replaced by a two-medium distribution.

The steps of a possible interpretative technique are described. G. D. H.

Production.

1742. Automatic Operation of Flowing Oil Wells and Tank Batteries. J. N. Poore. *Petrol. Engr*, Aug. 1948, **19** (12), 70.—Control of an oilfield may be separated into three independent functions: (1) oil gathering; (2) tank-battery control; (3) measurement of fluid level in tanks.

(1) Start–stop flow valves for wells may be located at individual wells or centralized. For automatic operation, electrically operated valves controlled by a time switch are placed in parallel with the manual valves. Wells are throttled at the well-head as these valves are not suitable for throttling.

(2) Tank-battery control is effected by motor-operated valves on each tank inlet line and a float switch in each tank. This control system sequences filling of tanks, by-passes full tanks, if desired by-passes any tank, and shuts flow lines when all tanks are full.

(3) Tank fluid levels are generally read at individual tanks. C. G. W.

Oilfield Development.

1743. World Crude Production Tops Nine Million Barrels Daily. Anon. *World Petrol.*, Sept. 1948, **19** (10), 60.—In the first half of 1948 world crude-oil production

reached 9,031,900 b.d. This was 724,000 b.d. greater than the 1947 average. The increase in the western hemisphere was attained by drilling more wells, but in the Middle East improved transport facilities enabled the output to be raised. U.S. well completions averaged 3000 wells/month, and production rose by 10% in the first half of 1948. Venezuela's production rose by 13% to an average of 1,170,000 b.d. At the end of June, Venezuela had 6000 wells averaging 220 b.d.

The eastern hemisphere averaged 1,924,500 b.d. in the first half of 1948, the Near and Middle East providing 1,050,300 b.d. Saudi Arabia averaged 351,000 b.d. The new field, Ain Dar, is 27 miles west of Abqaiq, and has 250 ft of oil sand at about 6660 ft.

It is estimated that the U.S.S.R., together with Sakhalin and part of Poland, is averaging about 600,000 b.d., compared with 540,000 b.d. for the whole of 1947.

A table gives daily average producing rates by countries for the first half of 1948, together with data for 1946 and 1947. G. D. H.

1744. A Handful of 100,000,000-brl Fields Produce Bulk of Oil. C. J. Deegan. *Oil Gas J.*, 29.7.48, **47** (13), 183.—111 U.S.A. fields with estimated ultimates of 100 million brl or more gave 47·7% of the output in the first half of 1948, and to date have given 55·6% of the U.S. cumulative production. They hold 59·7% of the remaining reserves and are expected ultimately to give 57·2% of the U.S. cumulative production.

A table lists these fields with their discovery year, estimated ultimate, remaining reserves, cumulative production, output in the first half of 1947 and 1948, type and age of main producing horizon. G. D. H.

1745. Middle East Production Expected to Exceed that of Venezuela in 1948. Anon. *Oil Gas J.*, 2.9.48, **47** (18), 44.—Currently Middle East oil production (including Egypt) is 1,155,000 b.d. In June Venezuela produced 1,338,000 b.d. The Middle East may pass this figure before the end of 1948, and the Middle East is expected to give 1,620,000 b.d. in 1951.

Kuwait gives 145,000 b.d., and Saudi Arabia 419,000 b.d. Including Ain Dar, Saudi Arabia may have reserves of 10,000 million brl. Egypt now produces 35,700 b.d., 7400 b.d. coming from Sudr. Asl has a potential of 3000 b.d. Qatar is expected to be able to supply 20,000–25,000 b.d. in 1950 if an outlet is available.

G. D. H.

Transport and Storage.

1746. Tapline—Biggest Inch Carrier Super Problem in Logistics. R. Finnie. *Oil Gas J.*, 23.9.48, **47** (21), 194.—The Trans-Arabian Pipe Line Co.'s new line across Arabia from the Persian Gulf to the Mediterranean has been in course of construction for a year. The main camp and unloading point, Ras el Misha 'ab, is now a town, with power-plant, sewage system, and all modern services; camp and harbour are finished; all surveying is complete; and much of the pipe is actually in service. This has meant intensive planning in San Francisco and shipment of everything—materials, transport equipment, repair facilities, housing, and food—from the U.S.A.

Unloading was speeded by the aerial cableway, Skyhook, and the first pipe arrived at Christmas 1947. Roads and airfields were constructed, and a distillation unit set up to obtain pure water. Construction problems were many, including carrying pipe-line overground in difficult country, sand clearing and excavating with bulldozers and scrapers, fights against sandstorms, flies, and heat. W. M. H.

1747. Fundamentals of Pipeline Design. B. Miller, *Oil Gas J.*, 16.9.48, **47** (20), 127.—The physical mechanism by which a pressure gradient originates is dealt with. Pressure gradient is zero when there is no flow, and increases with flow rate.

A figure shows force on a disc of fluid flowing through a pipe, the disc being bounded by the pipe. G. A. C.

1748. Welded Aluminium Alloy Pipelines. B. J. Fletcher. *Oil Gas J.*, 23.9.48, **47** (21), 207–211, 301–304.—Aluminium was not used for pipelines before the war because it was expensive, its corrosion-resistance was doubtful, and suitable welding methods were not available. The price has now fallen, whilst that of steel has risen, and the

new aluminium alloys are very resistant to corrosion. The most satisfactory are of the heat-treated magnesium-silicide type; they are strong, and have good welding characteristics. When laid in well-drained soils they do not appear to need external coatings, but in marshy alkaline soils careful external protection is required. Precautions must be taken to prevent direct connexions between aluminium and steel, such as the use of insulating flanges at joints.

Argon-arc welding has now solved the problem of joining aluminium lines, and the process is described in some detail.

Costs for production and welding are rather higher for aluminium than for steel, but its lightness makes handling easy and rapid, and brings about substantial savings in manpower, equipment, and time. W. M. H.

1749. Contribution to the Graphic Solution of some Problems of Hydraulics. G. Daric and J. Pasqualini. *Rev. Inst. franç. Pétrole*, 1948, **3**, 87–94.—Pressure loss in pipes is considered for both streamline and turbulent flow. Equations relating the variables are derived and used as a basis for the construction of nomographs. Problems arising in the calculation of the gravity transfer of tank contents are discussed, and their solution by nomographs illustrated. (N.B.—The nomographs are not reproduced in the article but have to be purchased separately.) V. B.

1750. Colorimetric Method of Controlling Successive Pumpings. V. I. Chernikin and N. I. Chernikina. *Neft Khoz.*, 1948, (7), 53–54.—Successive pumpings of light-coloured petroleum products of similar sp. gr. can be controlled by adding dye to the front portion of a transfer and checking the transition point colorimetrically. By use of photo-electric equipment the routing of different products can be rendered automatic, depending on the optical density of the material passing through the line as compared to a colour standard. V. B.

1751. More about the Choice of Temperature for Pumping Viscous Liquids. R. S. Flyatau. *Neft. Khoz.*, 1948, (7), 57–58.—In the pumping of low-pour petroleum products it may be preferable, in place of heating the oil, to cool it to a temperature at which the Reynolds No. $\simeq$2000, if at the temperature in the feed tank the Reynolds No. is in the range 2000–10,000. The decision whether to cool or heat the liquid must depend on local conditions, such as the cooling-water temperature and the relative cost of water and steam. V. B.

1752. Reseating of Pumps. G. Cunningham. *Petrol. Process.*, Jan. 1948, **3** (1), 52.—Describes a special tool for reseating pumps using conventional ring-type packing, with diagrams. T. L. R.

1753. Economy in Tank Space by Steel Firewalls. Anon. *Petrol. Process.*, Mar. 1948, **3** (3), 209.—Steel firewalls provide economical safety barriers for oil-storage tanks, because they permit larger tanks per given area. Diagram and description of type in operation included. T. L. R.

1754. Economy of Space with Storage Tanks. F. L. Plummer. *Petrol. Process.*, July 1948, **3** (7), 671.—A type of steel enclosure for oil-storage tanks is described where the steel bottom of the tank is extended outward and a second steel shell is erected to form a moat having a capacity equalling that of the enclosed tank. This type of construction also prevents escape of liquids into the ground underneath the shell. The ring of steel plates forming the outer wall is supported on a concrete-ring foundation. The top of the steel dyke is stiffened with an inside wind girder, which in addition serves as a deflector to reduce the possibility of a "boil-over" wave. Fire tests in an open-top tank are briefly reviewed. T. L. R.

1755. Types of Tank Cars (Refiners' Notebook No. 215). W. L. Nelson. *Oil Gas J.*, 23.9.48, **47** (21), 323.—A table shows the kinds of tank car used for various petroleum liquids or commodities handled by refineries. Specifications for tank cars of several bodies in the U.S.A. are discussed, and the various letters and designations tabulated and explained. W. M. H.

Refinery Operations.

Refineries and Auxiliary Refinery Plant.

1756. Effects of Acid and Alkali Wastes and Their Disposal. W. B. Hart. *Petrol. Process.*, May 1948, **3** (5), 409.—Acid and alkaline wastes are discussed, and their effects on surface waters (primarily on pH), and methods of handling them. Two general disposal procedures are covered–controlled disposal, in which the waste material is discharged only in such quantities as can be diluted to a safe level by the available receiving water, and neutralization, in which the deleterious effects of the waste are neutralized prior to disposal. T. L. R.

1757. Repair of Cooling Coils. J. C. Albright. *Petrol. Process.*, Jan. 1948, **3** (1), 54.—Describes removal of a leaking submerged cooling coil without shutdown of the condenser. T. L. R.

1758. Sample Line for Hot Residua or Heavy Tars. Anon. *Petrol. Process.*, Feb. 1948, **3** (2), 117.—Describes an air-cooled sample line eliminating need for a water cooler, requiring no attention or preliminary operation than a thorough bleeding so as to obtain a true sample. T. L. R.

1759. Economy in Cooler Surface in Condensing Gas-Gasoline Mixtures. G. W. Stephenson. *Petrol. Process.*, May 1948, **3** (5), 416.—Saving of approx 50% in cooler surface is claimed in cooling hot gasoline contaminated with "uncondensable" gases, by using a small exchanger and countercurrent scrubbing of the remaining vapours against gasoline. T. L. R.

1760. Liquid Bromine in Removing Algæ from Cooling Towers. J. C. Albright. *Petrol. Process.*, May 1948, **3** (5), 421.—Removal of algæ from a 10,000 g.p.m. cooling tower has been accomplished by treating with liquid bromine at the rate of 10 lb/day. Claims to be more economical than use of chlorine are stated. Bromine is three times as effective, weight for weight, as chlorine. Safety precautions necessary and details of operation are outlined. T. L. R.

1761. Anti-Corrosion Shield for Rising-stem Gate Valves. Anon. *Petrol. Process.*, Apr. 1948, **3** (4), 312.—Recommends use of a cap to cover exposed valve stem together with thick high m.p. grease, to prevent corrosion. T. L. R.

1762. Corrosion Prevention in Refinery Heat Exchangers. M. A. Furth. *Petrol. Process.*, June 1948, **3** (6), 549. (*Paper presented before A.P.I. Refining Division at Philadelphia*, May 1948.)—Gives brief statements on the following subjects: (1) types of crudes involved and their relative effects on corrosion; (2) experiences in chemical neutralization of corrosive agents. These are introductory to: (3) types and effects of corrosion losses in shell-and-tube and submerged-handle types of heat exchangers; (4) types of metal alloys used to resist corrosion of various exchanger parts, and the methods of application of such alloys. T. L. R.

1763. Corrosion in Overhead Condensing Equipment. E. N. Salathe. *Petrol. Process.*, June 1948, **3** (6), 555. (*Paper presented before A.P.I. Refining Division at Philadelphia*, May 12, 1948.)—The experience of Standard Oil Co. (Ohio) is reviewed, in regard to choice of overhead condensing equipment on refinery plant. Selection of material and pH control are briefly indicated for various processes. T. L. R.

1764. Flow of Fluids through Porous Media. Part 1. Single Homogeneous Fluids. L. E. Brownell and D. L. Katz. *Chem. Engng Prog.*, 1947, **43** (10), 537–548.—A general correlation is presented for the flow of single homogeneous fluids through porous media. A theory of flow through a porous bed is developed from Reynolds number and friction factor used for flow through pipes. The influence of the porosity of the bed, and of the sphericity and roughness of the particles are discussed, and a chart is given for the prediction of the effect of the sphericity and porosity on fluid flow. J. G. H.

1765. Flow of Fluids through Porous Media. Part 2. Simultaneous Flow of Two Homogeneous Phases. L. E. Brownell and D. L. Katz. *Chem. Engng Prog.*, 1947, **43** (11), 601–612.—The general correlation developed in Part 1 for single-phase flow through porous media is extended to cover the simultaneous flow of two liquid phases. The flow of wetting and non-wetting fluid is distinguished, and separate flow equations developed. The significance variables affecting flow are combined to produce a Reynolds-number–friction-factor plot. J. G. H.

1766. Flow of Fluids through Porous Media. Part 3. Application to Rotary Vacuum Filtration. L. E. Brownell and D. L. Katz. *Chem. Engng Prog.*, 1947, **43** (12), 703–712.—Reynolds-number–friction-factor relations for single- and two-phase flow through porous media developed in earlier papers are applied to the rotary vacuum-filter cycle. Integration methods for "unsteady" states resulting from charging-cake thickness during deposition and for turbulent or laminar flow are described; results so obtained facilitate calculation of coke deposition, air flow, and final moisture content in the filter cycle. J. G. H.

1767. Theories of Fluid Flow and Their Application to the Petroleum Industry. P. Lefèvre. *Bull. Ass. franç. Tech. Pétrole*, 1948 (71), 1–24.—A lecture giving a historical review of the classical experiments in fluid flow, followed by a non-mathematical account of contemporary methods of calculation in this field, including a brief explanation of the part played by pipe roughness in influencing flow. V. B.

1768. Cooling of Fireboxes. Anon. *Petrol. Process.*, Feb. 1948, **3** (2), 118.—Outlines a portable draught chimney and steam siphon, useful for quickly cooling fireboxes on crude stills and boilers. T. L. R.

1769. By-Product Fuels. Anon. *Petrol. Process.*, Feb. 1948, **3** (2), 140.—Concerns a discussion of refinery by-product fuels included in a paper presented to A.S.M.E. Dec. 1–5, 1947, by O. de Lorenzi entitled "Furnaces for By-Product Fuels"; the pertinent extract is reproduced.

The properties and use of asphaltic pitch, petroleum coke, acid sludge, and refinery gas are described, and considerations for furnace design for their use are outlined briefly. T. L. R.

1770. Furnace Tube Repairs. Anon. *Petrol. Process.*, Aug. 1948, **3** (8), 749.—A useful portable ratchet-jack for maintenance, removal, and reinstallation of heavy return bends on the lower ends of heater tubes on deFlorez furnaces is described. T. L. R.

1771. Gas Compressor Maintenance. Anon. *Petrol. Process.*, Mar. 1948, **3** (3), 223.—Recommends use of pneumatically operated special tools for time-saving in cleaning gas-compressor ports. T. L. R.

1772. Shell and Tube Heat Exchangers. F. L. Rubim. *Refiner*, July 1948, **27** (7), 395.—An attempt is made in this article to clarify the nomenclature of the more common types of heat exchangers. In addition, much information is given on the construction of and the materials used in various types of exchangers, such as the fixed tube, the floating head, and various others. The installation, operation, and cleaning of heat exchangers is also dealt with. The capital and maintenance costs of the equipment are considered in relation to their design. H. A. C.

1773. Repair of Heat Exchangers. Anon. *Petrol. Process*, Feb. 1948, **3** (2), 117.—Describes two tools useful for quick, easy, and safe removal of tubes from condensers, coolers, and heat exchangers, greatly simplifying maintenance. T. L. R.

1774. Heat Transfer Unit Using Inorganic Salt Mixture. W. C. Uhl. *Petrol. Process.*, Jan. 1948, **3** (1), 65.—An inorganic salt mixture, chemically stable and involving no v.p. in temp range 290–1000° F, has been adapted for use as heat-transfer medium in a new automatically controlled high-temp heat-transfer device. The salt is similar to that used in the Houdry fixed-bed catalytic-cracking process, a eutectic mixture of

sodium nitrate, sodium nitrite, and potassium nitrate. Properties of the salt are briefly enumerated. Details of a unit planned to use this salt on heat exchangers of up to 2,500,000 B.Th.U/hr capacity are outlined. Tests on safety precautions carried out are summarized. T. L. R.

1775. Factors that Influence Thermal Conductivity of Porous-type Insulating Material. A. V. Butterworth. *Chem. Engng Prog.*, 1947, **43** (11), 597–600.—Investigations are described covering the thermal conductivity of a commercial slag wool-type insulation as typical of porous-type insulating materials. Points covered include effect of pressure, temperature, composition of the gas atmosphere, and service age on thermal conductivity. Data collected show that thermal conductivity increases linearly with temperature at a rate which is independent of the pressure, changes directly with the thermal conductivity of the gas filling in the insulation pores, and does not increase markedly when operated in a hydrocarbon–hydrogen atmosphere for a period of 1100 hr. J. G. H.

1776. Pressure Drop through Packed Tubes. Part 1. General Considerations. M. Leva. *Chem. Engng Prog.*, 1947, **43** (10), 549–554.—Analysis of the energy requirements needed to force gases and vapours through packed columns in the investigation of synthetic liquid-fuel processes called for the provision of pressure-drop data for a large variety of packing materials. By analogy with flow through empty conduits an equation was developed which permitted the estimation of pressure drop through packed columns; this was confirmed by experimental evidence. It was found that there was no fundamental difference between pressure drops through round packings and through materials of other shapes, and also of more than one component. J. G. H.

1777. Pressure Drop through Packed Tubes. Part 3. Prediction of Voids in Packed Tubes. M. Leva and M. Grummer. *Chem. Engng Prog.*, 1947, **43** (12), 713–718.—Investigations made with uniform and mixed-size smooth spheres, with rough spheres, smooth and rough cylindrical particles, and Raschig rings revealed the existence of a definite relationship between the voids and the ratio of particle to tube diameter. A chart summarizes the results obtained with these materials which may readily be used in design calculations; indications are given of the manner in which the correlations so obtained may be extended to other particles, such as rings of different dimensions. J. G. H.

1778. Pressure Relieving Systems. N. E. Sylvander and D. L. Katz. *Petrol. Process.*, July 1948, **3** (7), 642.—Practical data on principles and methods for providing pressure relief for refinery equipment are described. Notes are given on the determination of relief capacity needed. The following instances are given particular consideration: failure of cooling-water supply, reflux failure, entrance of a more highly volatile fluid, vapour regeneration due to fire exposure, excessive heat inputs other than from fire, accumulation of non-condensible gases, closed outlets, overfilling a pressure storage vessel, and the failure of automatic flow, temp, or pressure control valves. T. L. R.

1779. Pressure Relieving Systems. N. E. Sylvander and D. L. Katz. *Petrol. Process.*, Aug. 1948, **3** (8), 774.—The paper covers the recommended procedure for computing the theoretical relief area needed for a given capacity, the various types of relief devices which can be used, and their proper location and mounting. T. L. R.

1780. Internal Insulation of Pressure Vessels and Piping, at High Temperature. P. E. Darling. *Petrol. Process.*, Apr. 1948, **3** (4), 339.—Application of internal insulation gives satisfactory and economical construction of vessels and piping for a number of processes where requirements of large lines and vessels for high-temp service make use of suitable alloy steels uneconomic. Practical examples are given of the factors involved and problems met in use of internal insulation in vessels and piping on a hydroforming and a fluid cat-cracking unit. T. L. R.

1781. Longer Life for Plunger Pump Packing. J. C. Albright. *Petrol. Process.*, May 1948, **3** (5), 415.—Packing life is increased by introducing a system of force-feed lubrication to the plungers of the pump, via the stuffing box. T. L. R.

1782. Refacing Pump Valve Seats. R. C. Steinhoff. *Petrol. Process.*, July 1948, **3** (7), 655.—A portable grinder, motor-driven for refacing valve pump seats *in situ* has proved satisfactory and economical. T. L. R.

1783. Improved Pump Base. J. C. Albright. *Petrol. Process.*, Aug. 1948, **3** (8), 750.—A pump base which provides toe-room, so that maintenance men can stand against the unit without bending over to reach parts requiring attention, is described. T. L. R.

1784. Electrical Features of Humble's Refined Products Pipeline. F. O. Stivers, J. E. Barbee, and M. A. Hyde. *Oil Gas J.*, 23.9.48, **47** (21), 174–175, 274–278.—Humble Pipe Line Co. have just completed two semi-automatic pump stations on their line from Baytown Refinery to Dallas and Fort Worth. Electric motors drive the pumping equipment, and auxiliaries are electrically controlled.

The main-line pumps are driven by 400-h.p., 3600 r.p.m., 2300-V, squirrel-cage motors, which are explosion proof, and can be coupled directly to the pumps without an intervening fire wall. All principal station functions are centrally controlled from an electrical control desk and associated gauge panel, installed in a separate control-room with indoor electrical switchgear. The pump-room, from which air is exhausted, is considered a hazardous, the control-room a non-hazardous area. Sirens and lights bring all types of main-line pump-unit failure to the operator's attention, and a special safe telephone has been installed. W. M. H.

1785. Emulsion Breaker to Improve Oil–Water Separation System. Anon. *Petrol. Process.*, Apr. 1948, **3** (4), 312.—Separator is a commercial design especially constructed to handle hydrocarbon–water emulsions. It contains a cartridge which breaks the emulsion by coalescing the droplets of oil and water, and a settling space where it separates into two layers. T. L. R.

1786. Oil–Water Separator—New Design. L. Ross. *Petrol. Process.*, Feb. 1948, **3** (2), 114.—Capacity of 80,000 g.p.m. separator differs from the standard A.P.I. in some respects. It uses same basic principle of separation by gravity differential. The film-rupture tray in the primary chamber of the A.P.I. model is replaced with a straight weir plate, and only one chamber is used for each of the twenty separator sections, with a common influent channel serving them all. The twenty sections were necessary to handle the large quantities of water; water distribution to all these sections was a problem, and this was overcome by a central split channel, whence the water flows to the distribution chambers. From each of these, the water flows over a full-width weir into the main separator sections. The overflow weir previously mentioned tends to distribute water evenly into the main separator chamber and also assists in breaking up the oil globules in similar manner to the film-rupture tray of the A.P.I. design. The film-rupture tray filled with Raschig rings was not used, as plugging conditions had been observed in the rings elsewhere, thus causing by-pass of the section. Adequate photographs and drawings are included. Design considerations are given. T. L. R.

1787. Checking Balance of Shafts. Anon. *Petrol. Process.*, July 1948, **3** (7), 656.—Portable jigs are described which enable one to perform most shaft-balancing jobs on the spot, without dismembling and balancing on a lathe. T. L. R.

1788. Use of Carbon Steel in Processing Sour Crudes. Anon. *Petrol. Process.*, Feb. 1948, **3** (2), 111.—Low-cost carbon steels were used in construction of a T.C.C. unit. After 222-day run, with on-stream eff of 96·4%, and processing a reduced crude of sulphur content of the order of 0·9%, a shut-down inspection was made. Corrosion and erosion inspections on the reactor indicated no loss of metal from the shell or internal metal parts, although all parts had been made of low-carbon steel. Serious

corrosion occurred only in the transfer lines between the heaters and tar separator, and the hot-tar line from the bottom of the tar separator. T. L. R.

1789. Maintenance of Stainless Steel Equipment in Refineries (2). W. G. Renshaw. *Petrol. Process.*, Feb., 1948, **3** (2), 155.—Deals with stress and local corrosion, wear and abrasion, and cleaning methods.

Although stress corrosion in stainless-steel equipment can best be prevented by careful design, construction and installation so as to avoid setting up stresses, a number of operating conditions also contribute. Examples given include pressure reversals, cyclic vibrations, and non-uniform heating.

Emphasis is placed on thorough and periodic cleaning. Turbo-cleaning is recommended for coke removal from heater tubes, other deposits by acids, preferably nitric acid. Warning is given against operating equipment beyond its design specifications. Problems encountered in refrigeration and hydrogenation are discussed, and methods are given for handling wear and abrasion. T. L. R.

1790. Maintenance of Plug Valves. R. E. Bush. *Petrol. Process.*, Mar. 1948, **3** (3), 251.—Describes in detail the correct and incorrect operation of plug valves and stop-cocks, also their maintenance and repair. Importance of proper lubricant is shown. Operational limitations and maintenance problems peculiar to each of the three main types of plug valve are described. T. L. R.

1791. Drop-out Valves—Remote Control. J. C. Albright. *Petrol. Process.*, Apr. 1948, **3** (4), 311.—Describes installation and operation of motor-operated drop-out valves, remotely controlled, with advantages over cable-operated type. T. L. R.

1792. Welding Turntable. J. Wallen. *Petrol. Process.*, Mar, 1948, **3** (3), 225.—A turntable enabling welder to work in a down-hand position at all times is described in detail, with photograph. T. L. R.

1793. Coupling for Welding Pipe in Service. Anon. *Petrol. Process.*, May 1948, **3** (5), 406.—A new coupling is designed to permit welding pipe while it is under pressure, and, preferably, while a stream of fluid is moving through it. Claims to save from 2 to 24 hr maintenance time. T. L. R.

1794. Acetylene Cutting Torch Improvement for Awkward Washing Jobs. Anon. *Petrol. Process.*, Aug. 1948, **3** (8), 750.—A reshaped cutting-torch tip is described which is useful where a conventional tip would be awkward to handle in washing an old bead from a weld in a vessel, or when equipment is to be cut down for preservation of plate edges so that rebuilding can be accomplished satisfactorily. T. L. R.

Distillation.

1795. Paving Asphalt from California Crude Oil. M. L. Kastens. *Industr. Engng Chem.*, Apr. 1948, **40** (4), 548–557.—Petroleum asphalts can be divided into: (1) cracked asphalt, produced in thermal cracking operation; (2) blown asphalt, produced by blowing air or steam through straight-run or cracked asphalt distillates to give a product of high softening point, low flow at atmospheric pressure and increased weather resistance; and (3) straight-run asphalt produced by distilling off the lighter fractions of an asphaltic-base crude. The latter type is the most important from the bulk production standpoint and a straight-run asphalt plant is described in detail. Crude from storage is passed through heat exchangers and flashed to remove light ends and water and so precipitate inorganic salt before passing to the main vertical furnaces. Three cuts are taken in the fractionating column, a light naphtha, a side cut which is used as a heat-transfer medium for storage heating, and the asphaltic bottoms which are steam stripped. Fume disposal is considered in detail. G. K. A.

1796. Column Design for Ternary Mixtures (Part 9). R. R. White and W. T. Boyd. *Petrol Process.*, Feb. 1948, **3** (2), 143.—This article presents an analysis in detail of the design calculations for complete columns distilling ternary mixtures with special emphasis on the important limiting case of min reflux. T. L. R.

1797. Production of Synthetic Gas. By Reacting Light Hydrocarbons with Steam and Carbon Dioxide. R. E. Reitmeier *et al.* *Industr. Engng Chem.*, Apr. 1948, **40** (4), 620–626.—Curves and equations are formulated which make possible the selection of reacting mixtures of light hydrocarbons, steam, and/or carbon dioxide to produce a synthetic gas of wide composition range without carbon deposition. Mixture compositions to give synthetic gas having hydrogen–carbon monoxide ratios of from 3 to 0·5 are plotted for varying reacting temperatures.

Pilot-plant investigation give products agreeing with those predicted from the curves and with no carbon deposition. G. K. A.

1798. Laboratory Still for Atmospheric or Vacuum Operation. Anon. *Petrol. Process.*, May 1948, **3** (5), 418.—This still, described in detail with illustrations, is satisfactory for vac down to 2 mm. Hg., and up to 450° F operating at atm pressure. Two safety devices are incorporated: one to extinguish the burner in case of a severe pressure surge giving rise to "puking" when operating with a dangerous sample, and another a vent line from the still head to the condenser side of the stop-cock in the overhead take-off line. T. L. R.

1799. Calculation of Theoretical Plates in Rectification. A. M. Eshaya. *Chem. Engng Prog.*, 1947, **43** (10), 555–560.—Bases for the determination of the number of theoretical plates for distillation are outlined, and present methods of determination are indicated. A new method, limited to binary mixtures, is based on the rectification of the equilibrium curve. Its application to ideal and non-ideal systems is explained, together with its adaption to other mass-transfer operations. J. G. H.

1800. Vacuum Distillation of Petroleum Residues. W. W. Kraff. *Industr. Engng Chem.*, May 1948, **40** (4), 807–819.—A modern, simple petroleum-residue distillation unit has two functions: (1) the preparation of distillate for charging stock to cracking unit; and (2) the production of asphaltic residue. The characteristics of vacuum distillation are discussed, and a description of the plant required is given in detail. The components discussed include the furnace, vapour–liquid separation and residue stripping, fractionating columns and trays, condenser design, and vacuum-producing equipment. G. K. A.

Absorption and Adsorption.

1801. Fiberglas Packing in Gas-Absorbing Systems. G. C. Williams, R. B. Akell, and C. P. Talbott. *Chem. Engng Prog.*, 1947, **43** (11), 585–596.—Mass-velocity and mass-transfer characteristics of Fiberglas packing used in vertical jackstraw arrangement in a 1-ft diameter column are evaluated. Pressure-drop data presented for Fiberglas compare satisfactorily with other packing; mass-transfer coefficients, while higher than for some other materials, are satisfactory. It is suggested that the most favourable field for the use of Fiberglas as a packing material is in the absorption field where high mass velocities are employed and where the height of the tower is not of extreme importance. J. G. H.

1802. Improvements in Liquid Petroleum Gas Recovery. G. W. McCullough, K. H. Hackmuth, and A. J. Miller. *Petrol. Process.*, Apr. 1948, **3** (4), 307.—For high propane recovery in gasoline plants, a significant saving in lean-oil stripping and cooling may be made by using a flash-flood system, in which only the oil required for pentanes absorption is totally denuded by steam stripping, the balance being flashed at low pressures for partial denuding and then introduced at a mid-point in the absorber. Reduction of ethane, methane, and sometimes hydrogen sulphide by simple venting is inadequate for economical recovery of propane and higher, and bubble-plate methods should supplement or supplant venting to improve separation efficiencies. Energy requirements for pumping, stripping, and cooling of absorption oil necessary for high propane extraction and recovery indicate that future plants may make this separation more economically by low-temp liquefaction, in place of absorption methods. T. L. R.

1803. Katy Gas-Cycling Plant. W. T. Robertson and H. M. Stamper. *Oil Gas J.*, 9.9.48, **47** (19), 64.—The Katy gas-cycling plant of the Humble Oil and Refining Co.

is described. Designed to process 458 million cu. ft. of gas per day from thirty-three producing wells, 80% of the potential butanes and almost all of the pentane and heavier hydrocarbons are recovered.

After extraction of L.P.G. and other fractions, some 388 million cu. ft/day of absorber residue gas is recompressed to 3100 p.s.i. for return to thirteen injection wells. The gathering system operates at 2700 p.s.i. at 130° F. Steam and electrically driven centrifugal pumps are mostly used, and the plant consumes 235,000 lb of steam per hour at pressures of 250,105 and 15 p.s.i., the electric-power load being 2500 kW. Four flow sheets illustrate the processes. G. A. C.

1804. Correlating Adsorption Data. D. F. Othmer and S. Josefowitz. *Industr. Engng Chem.*, Apr. 1948, **40** (4), 723–725.—Equilibrium vapour pressure of gases or vapours adsorbed in solid adsorbents are correlated with adsorbate concentration, pressure, and temperature. A three-dimensional evaluation of adsorption is presented using experimental data for one temperature, and this correlation is expanded into a nomograph for the determination of adsorption isotherms over a wide temperature range and sufficiently accurate for industrial adsorption. G. K. A.

Solvent Extraction and Dewaxing.

1805. Diesel Fuel, Cetane No. 50, from SO_2-extraction Plant. S. W. Dickey. *Petrol. Process.*, June 1948, **3** (6), 538.—Describes in detail with flow-sheet, photographs, and figures of properties and yields, a plant to produce diesel fuel oil of Cetane No. 50 at a charge rate of 5000 b.d. with SO_2 content of 6650 b.d., also to process kerosine at 5000 b.d. and naphtha at 4100 b.d. An Edeleanu plant is used. Special feed-drying facilities ensure that water entering the system and absorbed by the liquid SO_2 does not reach corrosive limits. Bubble tower drying of the SO_2-vapour stream, in place of use of conc. H_2SO_4, has been found effective. Removal of SO_2 from product streams is by bubble towers in place of shell-type evaporators. Switching of charge stocks is effected smoothly while the unit is running. T. L. R.

Cracking.

1806. Alumina Cracking Catalysts. V. M. Stowe, E. E. Marshall, L. L. Nickel, and R. S. Greenwood. *Petrol. Process.*, Apr. 1948, **3** (4), 317.—Kerosine was cracked over activated bauxite, activated alumina, and alumina impregnated with compounds of magnesium, boron, silicon, and fluorine. Iron compounds in bauxite are harmful, since they retard formation of aromatics, and produce gas and carbon deposit. Activated alumina, containing practically no iron, gave better yields of higher quality gasoline than the best bauxites.

Of the compounds added to the activated alumina, magnesia, chromium fluoride, and zinc fluoride gave high yields of liquid olefins; magnesium fluoride gave gas of increased density; boric acid, ammonium fluoborate, and fluosilicic acid gave high conversion rates. Best results obtained with an activated alumina containing about 3% silica. T. L. R.

1807. Improving Yields of Gasoline, Distillates from Pennsylvania Crudes. D. Read. *Petrol. Process.*, Apr. 1948, **3** (4), 329.—In thermal reforming of S.R. naphthas, pilot-plant studies show advantages in processing all available naphtha for gasoline blending at intermediate and low conversion levels rather than processing only part of same naphtha at high conversion level. Shown that it is more advantageous to prefractionate the full-range gasoline and reform only heavy naphtha rather than the full-range gasoline. This has effect of making more heater capacity available for naphtha reforming. If copper present in thermally cracked or reformed gasoline form sweetening, use of a metal deactivator additive will improve storage stability. Fluid catalytic cracking increases dist fuel yields obtainable when thermal cracking is employed. Adding a small amount of kerosine or light gas oil to reduce pour point and to lower 10% point to 440° F, the catalytically cracked cycle stock will meet No. 2 distillate fuel spec. Cycle stock is also acceptable diesel fuel. T. L. R.

1808. Manufacture of High-Octane Gasoline. T. B. Kimball and J. A. Scott. *Petrol. Process.*, July 1948, **3** (7), 659.—Various methods available with present refinery facilities for producing high-octane gasolines are reviewed from the point of view of their application by smaller refineries to maintain their competitive positions. Improved S.R. fractionation and reforming are emphasized. Improvements which can be made by "Polyforming" in place of thermal reforming are discussed, also the effect of replacing thermal cracking with catalytic cracking on the heavier fractions of the crude. Supplementing of catalytic cracking with thermal cracking of the catalytic cycle stocks for max yield of high-octane gasoline is included. The alternative use of catalytic polymerization is alkylation for processing of propane and butylene fractions is reviewed. T. L. R.

1809. Repair of Leaks on Fluid Cracking Units without Shutdown. R. H. Darling. *Petrol. Process.*, Apr. 1948, **3** (4), 349.—Describes in detail with illustrations repairs to cracks in butt-weld seams and lines, leaks at blown gaskets in flanged-pipe connexions or next to a valve or in a valve bonnet, and leaks at junctions between a small connexion and a large vessel or line. Success is achieved by venting or diversion of the hot catalyst or gases away from the welder, accomplished by either pulling a vacuum on the vent, smothering the leak with compressed steam, or venting the leak to atm. T. L. R.

1810. Channelling Effects in Reactors of a Commercial Hydroformer. C. Berg, P. N. Fawcett, and R. O. Dhondt. *Chem. Engng Prog.*, 1947, **43** (12), 719–730.—The effect of channelling on the performance of the catalyst bed in the commercial catalytic reaction is evaluated, and the lay-out and operation cycle of a pilot hydroformer for the investigation of channelling are described. J. G. H.

1811. Spherical Vacuum Flash Unit to Feed Twin Catalytic Crackers. D. P. Thornton, Jr. *Petrol. Process.*, Apr. 1948, **3** (4), 303.—The dimensions and details of design and installation of a 35,000 b.d. vacuum flash unit are given. The unit is unconventional in that it is spherical, although this has not been a major consideration; required dimensions were that length and breadth should be equal. Main requirements were, throughput—to be capable of long on-stream periods, readily accessible at all points for maintenance, and economical construction. T. L. R.

Polymerization.

1812. Catalytic Polymerization, and its Commercial Application. P. C. Weinert and G. Egloff. *Petrol. Process.*, June 1948, **3** (6), 585.—Catalytic polymerization using the "U.O.P." phosphoric-acid process is described fully. The three types of units—low-pressure regenerative; small high-pressure chamber type; and tubular units where closer temp control is achieved by means of a circulating medium—are described. Pretreatment of feed, by countercurrent caustic washing for sulphur removal, and nitrogen removal by contact with a stream of water in a countercurrent plate or packed column, is outlined. It is noted that water must be present in the feed to maintain the required equilibrium to prevent the catalyst being dehydrated. The effect of process conditions on the normal commercial polymerization operation is described. Also given are properties of polymer gasoline from non-selective polymerization of propylene–butylene mixtures in the three types of units. T. L. R.

1813. Catalysts for Hydrocarbon Synthesis. C. H. Riesz *et al.* *Industr. Engng Chem.*, Apr. 1948, **40** (4), 718–722.—The production of liquid hydrocarbons from carbon monoxide and hydrogen using a two-component catalyst was investigated, cobalt, nickel, or iron being used for hydrogenating action and thoria, silica, alumina, or zinc oxide for polymerizing. Although somewhat masked by carrier action, the results substantiated the idea of the two functions of the catalysts being hydrogenation and polymerization. The best catalyst combinations were found to be cobalt–thoria, cobalt–silica, and cobalt–alumina. Cobalt–thoria gave the highest liquid and lowest gas yield. The optimum yield occurred at about 75% metal content by weight. Nickel catalyst gave the highest yields of gaseous hydrocarbons. G. K. A.

Alkylation.

1814. Instrumentation of an Alkylation Unit. H. F. Moore and G. W. Gross. *Petrol. Process.*, May 1948, **3** (5), 441.—The control and measurement instrumentation on a large alkylation plant producing *iso*-octane aviation gasoline are discussed. The operating performances of the instrument installation are also analysed, from refinery records. In control units of this type, it is suggested that consideration be given to building storage spaces, such as reflux drums, tower bottoms, and vapour spaces, larger in relation to flow rates as a means for insuring a greater degree of stability in temps, pressures, and flow rates. T. L. R.

Chemical and Physical Refining.

1815. Desulphurization and Reforming of Naphthas. C. J. Helmers and G. H. Brooner. *Petrol. Process.*, Feb. 1948, **3** (2), 133.—The catalytic desulphurization of both S.R. and cracked naphthas by the vapour-phase catalytic treatment employing bauxite as catalyst is described, and figs are given for improvements in O.N. and lead susceptibility. It is noted that even though the sulphur content of the cracked gasoline may be relatively low, it may be desirable to treat it, since a part of the octane improvement of cracked stocks appears to be due to olefin isomerization. Applied to a high-sulpha naphtha prior to thermal reforming the process produces a low-sulphur reformed gasoline and results in higher yields of gasoline when reforming to a given leaded octane level.

Catalytic reforming of naphtha over bauxite differs from catalytic desulphurization in that a higher operating temp is required (950–1050° F as against about 650° F). The process produces some fixed gases and carbon, and the gasoline yield is correspondingly reduced depending on the degree of reforming. The clear octane rating of the reformed product is normally increased by 10–20 O.N. over charge stock, depending on the original rating, severity of reforming, and sulphur content of charge.

Catalytic desulphurization is obtained with catalytic reforming, but degree of sulphur removal is usually slightly less than that obtained at normal desulphurization temp. T. L. R.

1816. Atlantic Refining Co.'s First Year with Unisol. R. D. Bent and J. H. McCullough. *Oil. Gas J.*, 9.9.48, **47** (19), 95.—An account is given of the first year's operation of caustic-methanol solutions for extracting mercaptans from gasoline in the Atlantic Refining Co.'s Unisol plant at Philadelphia.

The plant capacity is 19,000 brl/stream day, designed to process two gasoline streams, one a low-boiling solubility blending stream, the other a fuel-range reformed gasoline.

Raw gasoline is first contacted with dilute caustic to remove hydrogen sulphide, and a portion of the pre-washed gasoline is contacted with water methanol from the mercaptan separator to remove small quantities of mercaptan in the water methanol that are distilled over with the recovered methanol.

The total pre-washed gasoline then flows upward through a countercurrent contact tower, where mercaptans are removed with methanol, and the latter itself removed in the upper section, the treated gasoline being finally water washed within the unit.

Although the products are not "doctor-sweet" they become so in the course of being blended to motor-fuel product, using Unisol treated product in up to 50% concentration. Odour control is by the human nose.

Tables show Unisol plant treating of various naphthas, range of mercaptan removal, and elimination of Gray vapour-phase treating of thermal reformed-visbreaker stream gasoline quality. G. A. C.

1817. Use of Oxygen in Gasoline Treating. C. O. Hoover. *Refiner*, July 1948, **27** (7), 355.—This process patented by the author in 1936 has been employed satisfactorily in forty plants since that time. It provides a cheaper method than any other of removing mercaptans from gasoline so that the product has a marketable odour.

The process consists of prescrubbing the sour charge with 18–20° Beaumé caustic-soda solution to remove hydrogen sulphide and the lower-molecular-weight mercaptans. A water wash is then given, and after being dried the gasoline is treated with oxygen in an eductor and the charge plus oxygen is introduced into reactors where a slurry of

cupric chloride on diatomaceous earth and water is circulated. The treated gasoline is again water washed to remove any carry-over from the reactors.

The reactions are an oxidation of the mercaptans to disulphides and a corresponding reduction of the cupric to cuprous chloride, the latter is oxidized by the oxygen present in the gasoline back to the cupric salt. The disulphides formed are innocuous.

H. A. C.

1818. Sulphonation Products of Mineral Oil. R. Sperling. *Industr. Engng Chem.*, May 1948, **40** (4), 890–897.—During the treatment of petroleum oil with fuming sulphuric acid in the production of highly refined medicinal and transformer oil, a complex mixture of sulphonation products is formed. The separation and examination of these products has been carried out, and a classification is suggested based on the three groups, oil-soluble monosulphonic acid, oil-insoluble monosulphuric acid, and oil-insoluble disulphonic acids. The results of Waterman analysis of these compounds are given and also the composition of the hydrolysis products of these sulphonic acids. G. K. A.

Special Processes.

1819. Batch Operation in Grease Manufacturing. C. L. Johnson and J. A. Altshuler. *Petrol. Process.*, Jan. 1948, **3** (1), 57.—Manufacture of lubricating greases can, in many cases, be put on an 8-hr day, 5-day week basis in place of practically continuous operation to achieve considerable saving in manufacturing costs. Such a step is accomplished by close chemical and manufacturing control and some additional equipment. Conversion of existing plants to the short-time-cycle batch operation requires equipment to weigh all ingredients, adequate pressure-saponification mixing equipment, and a means for fast high-temp heating. An interesting method for circulating oil in place of steam as a heating medium in compounding operations is described. (This article is a condensation of a paper "Grease Manufacture—Art or Science" given before the National Lubricating Grease Institute in Oct. 1947.) T. L. R.

1820. Design and Operation of First Hypersorber. W. F. Bland. *Petrol. Process.*, July 1948, **3** (7), 635.—The operation of a hypersorption unit, employed for demethanizing overhead gases is described. The unit has a capacity of 1,800,000 S.C.F. of feed gas/day, and has been operating since May 1947. The design of the unit is described in outline. "Fluid" technique is used for moving the activated carbon catalyst. In this unit, a Dowtherm boiler is used to supply heat to strip off the adsorbed C_2H_4. The advantages of this method are in getting away from direct firing or a high-pressure steam system, eliminating need for a circulating pump, and maintaining a more uniform temp. It has not been found necessary to reactivate the carbon in present unit as there are no heavy hydrocarbons in the feed gas. Carbon losses are 90–100 lb/day in circulation of 14,000 lb. Yield obtained of C_2H_4 92–93% pure, and only 0·1% CH_4. On a CO_2-free basis, product is 95·2% C_2H_4 and 99·9% C_2's. Max. ethylene content in discharge gas 0·1%. Difficulties were experienced in erosion in the centrifugal blower, and with thermal expansion in the lift line. The critical point in operation was control and maintenance of carbon level in the bottom of the hypersorber. If this level is lost steam is allowed to travel up the column, condensing in the cooling section and blocking the column. T. L. R.

1821. World's First Synthetic Glycerine Plant Opens at Houston. L. S. McCaslin, Jr. *Oil Gas J.*, 16.9.48, **47** (20), 88.—Details are given of the 8 million Houston plant of the Shell Oil Co., which is producing glycerine from propylene.

Propylene is chlorinated at high temperatures to form allyl chloride, which latter is then reacted with caustic soda, chlorine, and water through a series of steps to form a dilute solution of glycerine. The crude glycerine is concentrated, desalted, and purified.

The process is a result of twenty years' research and is estimated to yield about 20% of the requirements of glycerine for the U.S. The manufacture of alkyd resins and ester gums is the largest application for glycerine.

Six photographs and a flow sheet illustrate the article. G. A. C.

Metering and Control.

1822. Automatic Control of Liquid Level. H. E. McClatchey. *Petrol. Process.*, May 1948, **3** (5), 451.—A definition of averaging level control is arrived at mathematically, in order to determine the minimum length of the primary element—displacer float length or distance between differential manometer taps—and optimum settings of an ideal controller. The advantage of proper choice of control valve as regards size, and having the correct valve characteristic (lift *vs.* flow) in the line. The disadvantages of too high a throttling range in the controller, caused by the primary element being too small, is also discussed. T. L. R.

1823. Factors Governing the Choice of Restrictive Devices in the Measurement of Fluid Flow. R. W. Griffin. *Instrum. Prac.*, 1948, **2**, 504–506.—Instantaneous rate of fluid flow is commonly measured by application of Bernoulli's theorem to the pressure difference created across a change in flow area. The practical merits of devices available for this purpose are discussed. Orifice plates clamped between flanges with pressure tappings $D/2$ upstream and D downstream are accurate where there is at least $5D$ undisturbed flow upstream and pipe bore is carefully measured. To save space the pressure taps can be located in the flanges of large pipes or a special carrier ring provided. For dirty or corrosive fluids the alternative short nozzle is advised. These devices involve a loss of about half the measuring head. With the classical long venturi or short nozzle venturi the loss can be reduced to 10%. The former takes up more room, but is more accurate where it is preceded by an obstruction. Pitot tubes involve negligible pressure loss, but in practice are limited to flow in large gas ducts. R. T. D.

1824. The Derivative Controller. V. V. Tivy. *Petrol. Process.*, July 1948, **3** (7), 679.—Automatic controllers are sensitive not only to changes in the process they control, but also to effects which do not originate within the process itself. A derivative controller segregates these influences and either ignores or corrects for them before transmitting any response. The mechanism consists of a proportional controller, and into the input line carrying the response from the system is incorporated a resistance. This resistance superimposes on the proportional response a response proportional to pen rate. This is known as the "rate responses" or "derivative effect." Derivative controllers with single and compound bellows are described. T. L. R.

1825. Field Test for Propane Contamination of Butane Streams in Fractionator Control. G. T. Hamblen. *Petrol. Process.*, Apr. 1948, **3** (4), 315.—Test consists of immersion of thermometer in boiling sample of butane and observing minimum temp indicated. Temp is then correlated with propane content as determined by laboratory analysis. T. L. R.

Safety Precautions.

1826. Safety in Use and Handling of Ammonia. W. L. Nelson. *Oil Gas J.*, 16.9.48, **47** (20), 137.—No. 214 in the Refiner's Notebook series discusses handling and storage of anhydrous and aqua ammonia, protective equipment, safety showers, repair of tank cars and tools used.

Hazards with aqua ammonia are stressed as different from those obtaining with the anhydrous product. G. A. C.

Products.

Chemistry and Physics.

1827. Dielectric Constant of Petroleum Products. V. Cerchez and G. Oprescu. *Bull. Inst. Nat. Recherches Tech. Roumanie*, 1948, **3**, 55–60.—Measurement of dielectric const (ϵ) of eighteen Roumanian petroleum products ranging from light gasolines to fuel oils and including crudes and naphthenic acids gave values (at 20° C) in the range 2·050–2·680. ϵ varies with b. p.; the highest val was given by naphthenic acids (a polar material). Maxwell's relationship ($\epsilon = n^2$) holds for refined light products from

paraffinic crudes, but in the case of other oils there is divergence from this rule, indicating the presence of polar mol. In an attempt to correlate ϵ with other properties of the materials examined, a relationship was found between ϵ and D.I., applicable to refined diesel fuels. This can be expressed as D.I. $= 378{\cdot}5 - 907{\cdot}3 \log \epsilon$ and was verified in the D.I. range 43–68 for mixtures of diesel fuels of asphaltic and paraffinic origin. It is considered that with a more sensitive test apparatus a quant relationship could be determined between ϵ and characteristics such as the unsaponifiable matter content of naphthenic acids, the proportion of fatty oil in a compounded oil and the concn of a solution of asphalt in gasoline. V. B.

1828. Catalytic Reforming: Fundamental Hydrocarbon Reactions of Petroleum Naphthas with Molybdena–Alumina and Chromia–Alumina Catalysts. B. S. Greensfelder, R. C. Archibald, and D. L. Fuller. *Chem. Engng Prog.*, 1947, **43** (10), 561–568.—The performance of molybdena–alumina and chromia–alumina catalysts in the catalytic reforming of petroleum naphthas are evaluated. Chromia catalysts are most effective in the dehydrogenation of *cyclo*hexane homologues and the dehydrocyclization of amenable aliphatic hydrocarbons to aromatics. In the utilization of petroleum naphthas as feedstocks, coke formation on the catalyst is suppressed by hydrogen pressure. Molybdena catalysts under hydrogen pressure afford advantages in the dehydrogenation of *cyclo*hexane homologues, by their catalytic activity in paraffin isomerization and in dehydroisomerization of *cyclo*pentane homologues.

J. G. H.

1829. Methane–*n*-Butane–Water System in Two- and Three-Phase Regions. J. J McKetta, Jr. and D. L. Katz. *Industr. Engng Chem.*, May 1948, **40** (5),853–863.—The specific volumes and the compositions of the co-existing phases of the methane–*n*-butane–water system were obtained experimentally at temperatures of 100°, 160°, 220°, and 280° F and pressures to 3000 p.s.i.a., in the two-phase and three-phase regions.

The presence of water in the methane–*n*-butane system shifts the composition of the dew-point mixture at a given temperature and pressure by as much as 8%. Equilibrium constants relating the concentration ratios between the several phases are presented.

The distribution of the three components between the phases may be used to predict the water content of hydrocarbon phases and the solubility of gases in water.

G. K. A.

1830. New Researches on Molecular Adsorption as Related to Oiliness. J. Brigonnet. *Rev. Inst. franç. Pétrole*, 1948, **3**, 134–142.—Polar mol were added to highly refined lub. oil and the interfacial tension oil–water measured, using Trillat's modification of the du Noüy surface-tension balance. Continuous measurements of the interfacial tension were made showing its dependence on additive concn and temp. Most of the tests were with additions of oleic acid (10–2000 p.p.m.) and were made at 18° C, except when the effect of temp was being studied. Tests were also made with stearic acid (0·017%). Time taken for equilibrium to be attained varies linearly with temp and is inversely proportional to the latter, whilst the curve relating the relative lowering of interfacial tension at the equilibrium point to the temp has an exponential shape. The general trend of the results is the same for oleic and stearic acids, but the time taken to attain equilibrium is less and the relative lowering of interfacial tension greater in the case of the former owing to the unsaturated linkage causing greater adsorption of the acid on water. The curve of relative lowering of interfacial tension (at the equilibrium point) against temp shows, in the case of oleic acid, a break at 44° C, which would appear to be a transition point between two states of the adsorbed interfacial film. Tests with fatty acids of varying carbon chain length in the range C_{10-18} show that although the initial interfacial tension is independent of chain length, the value after 24 hr decreases progressively with increasing No. of C atoms.

V. B.

1831. Thermal Properties of Petroleum Oils. M. Van Winkle. *Refiner*, July 1948, 27 (7), 379.—Enthalpy–temperature charts for saturated and superheated petroleum vapours are given with an explanation of their use. Variables correlated in the charts

are 100% flash vaporization temperature, slope of the flash curve, A.P.I. gravity, and the U.O.P. characterization factor K.

A new method of calculating petroleum vapour enthalpies is given, where the vaporization characteristics of the fractions are correlated with heat content of saturated vapours at their dew point. H. A. C.

Analysis and Testing.

1832. Examination of Adsorbent Bleaching Clays and Catalysts by Means of X-Rays. C. L. Alexanian. *Rev. Inst. franç. Pétrole*, 1948, **3**, 104–110.—The results obtained from numerous X-ray diffraction spectra of finely powdered (200 mesh) bleaching earths and non-metallic catalysts are discussed. Three groups of adsorbent earths can be distinguished, which is in accordance with results previously obtained from a study of dehydration curves. The catalysts examined were both natural and synthetic alumino-silicates used in cat cracking; such examination can identify the type of material with a high degree of certainty. It is concluded that X-ray examination is a valuable tool for the production control of both bleaching earths and alumino-silicate catalysts. Fifty references. V. B.

1833. Cetane Rating on Small Samples. J. O. Chase and A. D. Rickett. *Petrol. Process.*, Feb. 1948, **3** (2), 120.—Shows how Cetane Nos. can be determined, by A.S.T.M. method, on fuel samples of 200 ml and in special cases 100 ml. Recommends using the older A.S.T.M. procedure A.S.T.M. D613-41T which requires only one setting of combustion-indicator gap as against three of the later A.S.T.M. D613-43T with same reproducibility (as indicated by examination of large number of analyses); further saving is made by alterations to fuel system, to reduce fuel losses in flushing the standard burettes each time engine is switched to the test sample by incorporation of an additional burette which can be used to measure fuel consumption rate of sample separately from that of the reference fuels. T. L. R.

1834. Correlating Densities of Liquids. A New Nomograph. D. F. Othmer *et al.* *Industr. Engng Chem.*, May 1948, **40** (4), 883–885.—The nomograph is based on the following equation, which is derived in the paper :—

$$f(d) = mf(T_D') + K$$

where d is the density of the liquid in question m and K are constants and T_D' is the critical difference temperature of a reference substance T_D' being defined as $T_D' = T_C' - T'$, T_C' being the critical temperature of the substance and T the temperature in question. The nomograph consists of a temperature and a density scale and a centre grid. It permits the determination of the density of a liquid at any temperature if the density is known at two temperatures. G. K. A.

1835. Gasoline Oxidation Tests, Multiple Unit for. E. L. Ruh, E. W. Cromey, and C. A. Neusbaum. *Petrol. Process.*, Jan. 1948, **3** (1), 45.—Multiple-unit bath for handling ten determinations simultaneously is described in constructional and operational detail. T. L. R.

1836. Method to Determine whether Cracking Units Require Shutdown. Anon. *Petrol. Process.*, Aug. 1948, **3** (8), 760.—Method is based on A.S.T.M. test D.158—distillation of gas oils and similar distillate fuel oils. The percentage of coke residue is found after dist sample from unit, and if this is greater than about 0·25%, it has been found by experience that the unit requires cleaning. T. L. R.

1837. Refractometric Determination of Oil Losses Due to Evaporation. V. G. Ben'kovskii. *Neft. Khoz.*, 1948 (7), 46–48.—Weathering loss of crude can be determined with an accuracy of 0·1% (using a refractometer capable of reading to 0·0005) by calculation from the n of the original crude, weathered crude, an added third component (suitably a S.R. gasoline of n 1·3800–1·3900) and of a mixture of the original crude with $\geq$ approx 10% of the added component. The method is based on the assumption that crude pet is a mixture whose constituents are additive with respect to n. Experimental procedure and methods of calculation are described. V. B.

1838. *Iso*-octane and Normal-heptane as Reference Fuels. H. M. Trimble, L. A. McReynolds, and W. Mitacek. *Petrol. Process.*, Aug. 1948, **3** (8), 705.—A series of tests have been carried out on the characteristics of *iso*-octane and *n*-heptane, as reference fuels, using laboratory C.F.R.-A.S.T.M. test engines. The primary fuels were found to compare favourably with secondary reference fuels in reproducibility, length of time of test, knockmeter reading stability, and engine cleanliness. For the induction systems of A.S.T.M. Motor and Aviation and the Research test engine, the use of a 5-in induction pipe in place of the conventional 2½-in pipe was found to improve engine-operating conditions, among other advantages. T. L. R.

1839. Polarographic Determination of Naphthalenes in Kerosine and Light Gas Oils. D. P. Thornton, Jr. *Petrol. Process.*, July 1948, **3** (7), 673.—The evident importance of naphthalene as a raw material in the synthesis of compounds such as phthalic anhydride, for example, have indicated the need for a simple routine method for the determination of naphthalenes in pet fractions. A procedure using the polarograph is based on the reduction bicyclic hydrocarbons at high negative potentials.
T. L. R.

1840. Correlating Surface Tension of Liquids. A New Nomograph. D. F. Othmer *et al. Industr. Engng Chem.*, May 1948, **40** (4), 886–889.—A nomograph is based on the equation $\log \gamma = m \log \gamma' + C$, where γ is the surface tension of the liquid, γ' is the surface tension of a reference liquid at the same critical difference temperature, and m and C are constants.

The nomograph consists of a surface-tension scale and a temperature scale and a centre grid, and it permits the surface tension of a liquid to be found at any temperature if the surface tension at any two temperatures is known. G. K. A.

1841. Proposed U.S. Army Test on Lubricants under Extreme Temperature Conditions. G. H. Vogel. *Petrol. Process.*, Aug. 1948, **3** (8), 761. (*Presented before Lubrication Committee of American Petroleum Institute at Tulsa*, April 1948.)—Describes a proposed U.S. Army tour over a distance of 20,000 miles to test lubricants under extremes of temp, within a range of operating temp of +125° F to −65° F. Turbo-propellor engines provide the most stringent requirements of any aircraft power on a lubricating oil. Synthetic greases for aircraft have been found to exhibit low torques at low temps, but may need improved wear characteristics and extension of their high-temp. range to make them universally applicable. T. L. R.

Crude Oil.

1842. Demulsification of Kokaitinsk Crude. E. A. Mushkin. *Neft. Khoz.*, 1948 (7), 48–51.—Kokaitinsk crude (sp. gr. 0·940, $E_{50} = 24°$), which can contain up to 50% water in the form of a persistent emulsion, was subjected to laboratory and works demulsification trials using gas oil "kontakt" (mol. wt. 295), sodium-naphthenate solution (containing 0·9% free NaOH), and aluminium sulphonate. Satisfactory water separation was obtained with 0·25% of the "kontakt" and approx 2% of the sodium-naphthenate solution. The effect of settling temp on the amount of demulsification agent required was examined in the range 60–90° C. A suggested lay-out for an emulsion-breaking plant is described. V. B.

1843. Sulphur Compounds of Nebitdag Crude. V. D. Yasnopol'skii. *Neft. Khoz.*, 1948 (7), 51–52.—Nebitdag crude contains 0·18–0·36% S and, on dist, H_2S is evolved and S deposited. Analysis of the crude showed absence of H_2S and S (cadmium acetate and Hg tests). Examination of the fraction up to 240° C for groups of S compounds indicated that about 65% of the total S was present in the form of sulphides and disulphides. Thiophene could not be detected. The H_2S and S are thus yielded by decomp of S compounds on dist. V. B.

Engine Fuels.

1844. Corrosion by Motor Fuels. P. Schläpfer and A. Bukowiecki. *Schweiz. Arch. Ang. Wiss. Tech.*, 1948, **14**, 257–274.—The literature on the corrosion behaviour of

motor fuels is reviewed, and the suggested corrosion reactions discussed. The chief corrosive agents are " aggressive " S, water, and acids. A relationship exists between the water-tolerance of a fuel and its dielectric const. Hitherto unpublished data is given on the solubility of atm O_2 in fuels; this ranges from 36·8 to 62·3 cm^3/l at 20° C. Corrosion tests were made on several motor fuels comprising an unleaded gasoline, six oxygen-containing fuels (methyl, ethyl, *n*-propyl and *iso*-butyl alcohols, acetone, and ethyl acetate) binary mixtures (mostly 1 : 1) of these with the gasoline, and three proprietary Swiss fuels containing paraldehyde; all these fuels were free from corrosive S. The fuels were tested in their normal state, with added water, and also acidified (chiefly with formic acid) to an acidity of 0·1 mg KOH/g. The metal test pieces, immersed in the fuel to ⅔ their length, were made from Fe (0·08% C), Al, Zn, Pb, Cu, and a Mg alloy containing Al, Zn, and Mn. Test lasted one week at 30° C. Visual changes (illustrated by photographs) were noted, and loss of wt determined. Neutral anhydrous fuels showed almost no attack except in the case of metals reacting with lower alcohols (Pb, Mg alloy) to form alcoholates. Acidified fuels showed slight attack, decreasing in the order Pb, Zn, Mg alloy, Cu; Al and Fe were unaffected. In the presence of water, attack was markedly increased, being inversely proportional to the polarity (as shown by dielectric const) of the fuel. This is explained as being due to an increased tendency of the water to deposit on the metal surface as the polarity of the liquid decreases. Fuels from which O_2 had been swept out by N_2 showed greatly decreased corrosion. Tests on mixtures of gasoline and oxygen-containing fuels indicate that addition of water in excess of 30% of the water-tolerance of the fuel causes marked corrosion. Corrosion is increased by a rise in temp and by agitation of the sample. Hydrocarbon fuels having a water-tolerance $<0·2\%$ should be stored in absence of free water, whilst mixed fuels with a water-tolerance $>0·2\%$ should have the water content maintained at $\not>30\%$ of the water-tolerance figure. Thirty-eight references. V. B.

1845. Diesel Fuels from Catalytic Cracking Operation. T. L. Apjohn and F. L. Nelson. *Refiner*, July 1948, **27** (7), 346.—Due to various causes, among which increasing demand for high-octane gasoline is of importance, catalytic cracking is becoming more in favour in refinery operations. As a result the supply of straight-run distillate fuel in the diesel range is becoming less. It is evident that more diesel fuels will have to come from cracked stocks. The authors say that it is unfair to class catalytically cracked fuels with thermally cracked, as experience of diesel operators with the latter has not been favourable.

Information on catalytically cracked fuels from Houdry and T.C.C. plants have shown that, notwithstanding lower than normal Cetane Nos., there is little difference from distillate fuels in laboratory test results provided that engines are run at high load and normal operating temperatures. The Cetane No. of the catalytically cracked fuels is usually five to fifteen lower than the Cetane No. of the straight-run stocks from the same crude. This is not so serious when paraffinic-base crudes are being treated, but when naphthenic-base stocks are being treated the Cetane No. of the diesel fuel produced may be as low as twenty, which is ruled out under present-day diesel-fuel specifications. H. A. C.

1846. Tail-end Volatility of Gasoline. J. Bennett Hill and W. C. Huffman. *Petrol. Process.*, June 1948, **3** (6), 567. (*Review of paper presented before A.P.I. Refining Division at Philadelphia*, May 10–13, 1948).—The effect of heavy ends in gasoline, in relation to present-day refining and automobile performance, is reviewed. The trend with refiners up to the advent of catalytically produced gasoline was for a decrease in end-point, chiefly to improve O.N. The O.N. of straight-run and thermally cracked gasoline decreases appreciably with increasing end point. With catalytically cracked gasoline, there is substantially no decrease in octane-rating in the higher boiling fractions. There is, therefore, no advantage in O.N. by decreasing the end-point of a catalytic gasoline, and this is only limited by the uncracked charge contaminating the product. There is, however, a disadvantage in using a higher end-point, in the deterioration of warming-up properties. The problem is discussed with regard also to the economic advantage in increased production of gasoline, and suggested refinery processing is outlined and discussed from this aspect. T. L. R.

1847. Efficient Utilization of Refinery Butanes in Motor Gasoline. T. L. Apjohn and D. P. Heath. *Petrol. Process.*, June 1948, **3** (6), 573. (*Review of paper presented before A.P.I. Refining Division at Philadelphia*, May 10–13, 1948.)—The efficient use of butanes is considered from the point of view of potential-energy recovery rather than on the basis of economic return to the refining industry. As an alternative to direct blending in motor gasoline, the conversion of the butane–butylene fractions to liquid fuel products, is considered.

On the basis of available data higher energy recoveries could be made by chemical conversion of excess butanes to gasolines than by direct blending into gasoline. This conclusion is reached on consideration of the high evaporation losses encountered from automobile tanks and carburettors, which losses could be considerably reduced by alterations to fuel-system designs. T. L. R.

1848. Greater Use of Light Ends in Winter Motor Fuels. Anon. *Petrol. Process.*, Jan. 1948, **3** (1), 33.—Road tests carried out by the N.G.A.A. on sixteen passenger cars with fuels of various V.P.s showed no tendency to vapour lock at atm temps below 55° F. with fuels of up to 15 lb. R.V.P. The pentane content of the fuels also had little effect on vapour-locking tendency below 55° F.

The test fuels were prepared by pressurizing two commercial base fuels with *n*-butane to 26 lb R.V.P.; the base fuel and corresponding pressurized fuel were then blended to give the fuel of required V.P. The unblended base fuels had the same R.V.P., but one was low in volatility and the other high.

Negligible tank losses are reported in going from fuels of 13–15 lb R.V.P. Economic considerations in a greater use of light ends in winter motor gasolines are presented. T. L. R.

1849. Volatility of Light Ends as it Effects Processing of High Octane Fuels. L. L. Davis. *Petrol. Process.*, June 1948, **3** (6), 565. (*Review of paper given before A.P.I. Refining Division at Philadelphia*, May 10–13, 1948.)—The interrelationship of volatility of light ends in motor gasoline and O.N. requirement is shown for a series of increasing octane levels in assumed refinery operations. Processing for high-octane gasoline, not only decreases the volume of base gasoline, but produces more butanes than can be utilized in 10-lb R.V.P. gasoline, thus decreasing the amount of external blending stock required. Improvement in the ability of automotive engines to use high V.P. fuels would provide means for increasing production to more than offset the volume loss in base gasoline through advancing the O.N. An increase in summer V.P. tolerance from 8 to 10 lb R.V.P. would increase production by 10–11%, thus more than offsetting the volume loss which will occur with O.N. increase of 10 units. T. L. R.

1850. Natural Gas Butane and Motor-Fuel Vapour Pressures. R. C. Alden and T. W. Legatski. *Petrol. Process.*, June 1948, **3** (6), 579. (*Review of paper presented before Mid-Year Meeting of A.P.I. Refining Division at Philadelphia*, May 13, 1948.)—The distribution of butanes and sources of origin are reviewed. The allocation to various uses is given. Of the available butanes only about 40% finds its way into motor fuel. It is stated that if fuel systems were to be improved so that an increase in R.V.P. of 1 lb could be tolerated, this could be done by addition of 9,700,000 brl of butane, which is equivalent to 21,700,000 brl of crude at 1946 gasoline-yield ratio, *i.e.*, a saving of 4½ days crude supply and refinery operation in 1946. T. L. R.

Gas Oil and Fuel Oil.

1851. Economic Utilization of Fuel Oil in Boiler and Industrial Furnaces. Part 2. A. Pearce. *I.P. Review*, July 1948, **2**, 202.—Fuel-oil-burning equipment is discussed under the headings: (*a*) mechanical atomizing; (*b*) steam or medium-pressure air atomizing; (*c*) low-pressure air atomizing; (*d*) rotary. These are illustrated by diagrams.

The mechanical atomizing burner is popular for steam generation on a big scale, but for general furnace work and burning of heavy oil, *e.g.*, for steel manufacture (soaking pits, mill and reheating furnaces), steam or medium- and low-pressure air-jet types are much used.

A comparison between efficiency and capacity for mechanical and steam atomizing

burners is given in graphical form. It is concluded that, with heavier fuel oil, the steam atomizing burner may have advantages over the mechanical unit, but wherever possible the use of steam should be avoided, as it involves both the loss of many B.Th.U. and a reduction in flame temperature. Experiments on the Continent indicate that the rotary type of burner has some advantages for certain purposes, and allows a wide range of fuels to be burnt successfully.

In general, the tendency will be to develop burners so that heavier oils can be employed for industrial purposes. Experiments are also being made on the burning of waste fuels, sludges, etc. W. M. H.

1852. Economic Utilization of Fuel Oil in Boiler and Industrial Furnaces. Part 3. A. Pearce. *I.P. Review*, Aug. 1948, **2**, 244.—Conversion from coal to oil-firing in many industries has shown that the latter fuel results in more economical production of power. This fact would be even further emphasized if the furnaces had been designed for oil-firing initially. A most important design factor is to ensure that the flame traverse is kept well clear of the water wall or steam-generating tubes. Refractory bricks containing high percentages of alumina are most suitable. The most likely direction in which development will proceed is the improvement in burner design to allow wider ranges of fuel to be burnt. O. M.

1853. Future Liquid Fuels. R. C. Gunness. *Chem. Eng. News*, 1948, **26**, 2123–2127, 2171.—In 1947 an increase in demand to 5·85 million b.d., one-third in excess of 1941 consumption, of liquid fuel (chiefly distillate and kerosine) has occurred. Oil and gas have supplied almost all the increase in energy production over the past twenty-five years. Energy production from coal has declined from 80% in 1920 to 48% in 1947 in the U.S.A. Liquid-fuel consumption is estimated to increase to 1·74 million b.d. by 1970. Increased yields of gasoline and distillate fuels are made at the expense of residual fuels, the demand for which is expected to decrease. The demand for liquid fuel will be covered by the increase in proved reserves of crude and the development of Middle East fields. Synthetic fuel oil from natural gas, shale, and coals could supply a large percentage of requirements, but would involve an immense capital outlay and tie-up of labour and material. The Fischer–Tropsch process, however, will soon be operating on a commercial scale in economic competition with crude oil. Recovery of oxygenated products goes far to make this process economically attractive. While automobile engine development is in the direction of higher compression ratios requiring higher O.N. gasoline, this is counterbalanced by the greater use of C.I. engines in trucks and the swing over to jet and turbo-jet power plant in aircraft. The sensitivity of high-speed C.I. engines to fuel quality will require fuels fitted to the particular engine and evaluated in terms of engine and fuel characteristics rather than the broad yardstick of Cetane No. E. S. E.

1854. Hot Oil Circulation. C. L. Kempton. *Heating Ventilating Engr*, Sept. 1948, **22** (255), 116.—Oil has the advantage over steam as a heating medium for industrial processes in that high temperatures are obtained at low working pressures and cost of plant employed is reduced.

Design of oil absorber for heating oil should avoid too close contact between fire and tube nest. Oil is used with a viscosity approx 40 sec Redwood I at 400° F, a fl. pt. of approx 600° F, and ability to withstand high temperatures without carbonizing.

Close observation on deterioration of the oil is necessary as it may affect rate of circulation. Pipework installations need particular care, as leaking joints cause oil deterioration; pipe runs should have lowest resistance to flow possible.

In some systems oil is by-passed through expansion tank to storage tank to liberate any moisture in the oil before it is circulated, as moisture causes foaming.

A system used for heating bitumen in the manufacture of roofing felts and damp courses is illustrated. D. W. J.

Lubricants.

1855. Accurate Method of Determining Engine Oil Consumption. W. S. Powell. *Auto. Ind.*, 1948, **98** (3), 35.—Difficulties of measuring the rate of lub. oil consumption of an internal-combustion engine under laboratory conditions are described, and

limitations of present methods are discussed. Details are given of a recording scale and controlled circulating system which gives a reliable and accurate determination of oil consumption. J. G. H.

1856. Fats and Fatty Acids in Lubricating Greases. Anon. *Institute Spokesman*, Aug. 1948, **12**, 4–6.—A preview is given of the new Hammond plant of Swift and Company for the production of industrial oils from glycerides, and fatty acids from animal, vegetable, and marine oils. Fat splitting, solvent fractionation, decolorizing, and destearinizing processes and units are outlined and illustrated by flowsheets; quality control systems and technical sales services are also described. J. G. H.

1857. Use of Rust Inhibitors in Lubricating Oils. V. V. Losikov, A. L. Khalif and L. A. Aleksandrova, *Neft. Khoz.*, 1948 (8), 47–52.—Tests were made on turbine oils with numerous additives to determine the anti-corrosion action of these latter. Test procedure was to suspend polished steel plates, which had been dipped in the oil, in a water-vapour bath at 40° and 70° C and to note the time taken for corrosion to become visually apparent, the A.S.T.M. D665-44T procedure was also used. Results show that chlorine and nitro derivatives of aromatic hydrocarbons, stearic, oleic, abietic, and naphthenic acids and their salts do not give adequate protection against corrosion, whilst unsaturated fatty acids are unsuitable owing to their bad effect on demulsification properties. Excellent results were obtained with specially synthesized mixed additives based on compounds having one or more double bonds and possessing so-called secondary valency (no further details given). These are designated "MT" additives and are used in amounts of 0·5%. In addition to giving good corrosion protection, these additives do not worsen (and in some cases improve) demulsification and have no deleterious action on the oxidation stability of the oil. V. B.

1858. Friction Oxidation. H. T. Morton and F. G. Patterson. *Institute Spokesman*, Aug. 1948, **12**, 8–10.—Conditions are described in a variety of industrial fields where early failure occurred in bearings subjected to vibratory conditions and oscillating motion of relatively small magnitude, and the effects of the lithium soap greases in combating this failure are reported. Investigations conducted in the Fafnir laboratories covering the mechanism of this type of bearing failure, now known as friction oxidation, and the special properties of lithium greases in this connexion are outlined, together with details and operating data of special testing equipment for the evaluation of greases for use where these conditions obtain. Conditions necessary for the effective operation of bearings required for oscillating use include reduction of load to 35–50% of catalogue table load, a total movement of the bearing sufficient to turn the balls 180°, minimum bearing looseness, and adequate seals and enclosures. Recommended lubricants are listed. J. G. H.

1859. Graphical Solution of Problems Concerning the Viscosity of Lubricating Oils as a Function of the Temperature. J. Groff. *L'Orientation Technique*, 1947, **2**, 111–117, 163–166; 1948, **3**, 87–90.—A brief discussion is presented of the principles of visc conversion charts and visc–temp diagrams. A nomograph is given covering the range 1–5000 cs, −20 to 200° C and V.I.'s of −50 to 150 whereby problems concerning the visc–temp relations of lub. oils can be solved. Conversions can be made for both the C and F temp scales between Barbey, Engler, Redwood, Saybolt, and cs units, and between V.I. and pole-height. A modified form of chart is also presented wherein the scales are adjusted so as to minimize errors otherwise occurring at high visc values. With a visc scale length of 630 mm for the range 0–10,000 cs, and assuming a reading accuracy of 0·2 mm an accuracy in the result of better than 0·5% is attainable; with a reading accuracy of 0·5 mm the result is accurate to approx 1%. The method of using the chart, and its applications, including the calculation of characteristics of binary and ternary mixtures, is explained with examples. V. B.

Special Hydrocarbon Products.

1860. Chlordane. J. E. Bussart and A. Schor. *Soap & Sanitary Chemicals*, Aug. 1948, **25**, 126–128.—Chlordane, a new insecticide developed during the war, is a chlorinated hydrocarbon with the empirical formula $C_{10}H_6Cl_8$. It has a multiple

effect on insects, acting as a stomach poison against leaf-eating insects such as grasshoppers, caterpillars, and potato beetles; as a contact poison against roaches, flies, mosquitoes, fleas, and bugs; and as a fumigant against flies and stored grain insects. It has also given excellent results against wireworms and livestock pests. Its toxicity to Man is about equal to that of D.D.T.

Chlordane can be formulated for use as an oil solution, emulsion concentrate, a dust, or a wettable powder. For household purposes it is used almost exclusively in solution in kerosine with which it is completely miscible. Several sample formulations are given. W. M. H.

1861. Petroleum Detergents. Anon. *Soap & Sanitary Chemicals*, Aug. 1948, **25**, 75–76.—Production of synthetic detergents in the U.S.A. is expected to reach 700–800 million lb/year by 1949, 60–70% of this being derived from petroleum, and including alkyl phenol sulphonates, alkyl sulphonates, and alkyl aryl sulphonates.

Most important are the alkyl aryl sulphonates, usually sold with an active material of 35–40%. In their manufacture, an alkyl group is combined with an aromatic hydrocarbon; the resulting alkyl aryl hydrocarbon is sulphonated, and the sulphonic acid formed is neutralized. The alkyl group is derived from a kerosine-distillate fraction obtained from the refining of paraffinic crudes with a boiling range between 185° and 290° C, and with 10–16 carbon atoms in the chain. Estimated production costs are given for a small plant. W. M. H.

1862. Commercial Uses of Petroleum Naphthas. H. N. Frot and C. A. Murray. *Petrol. Process.*, 1948, **3** (1), 17.—Describes use of petroleum naphthas in natural and synthetic rubber industry for making tyres, inner-tubes, cements and adhesives, and dipped goods; in protective-coating industry as solvent and thinners for paint, varnish, and lacquer; in extraction industry for dry-cleaning, extraction of vegetable, animal, and other oils and waxes; and misc uses for manufacturing inks, natural and artificial leather, brake-linings, waxes, and adhesive tapes. The properties required for the various uses are outlined briefly, and the tests by which these properties are measured are indicated. T. L. R.

1863. Hydrocarbon Oils as Wood Preservatives. J. A. Vaughan. *Petrol. Process.*, Mar. 1948, **3** (3), 237.—Specially reformed petroleum fractions, among other hydrocarbon oils, were studied to determine causes underlying the toxicity of the coal-tar creosotes for wood preservatives. Aromatic content and sp. gr.–b. p. relationship were factors related to toxicity, and these provide a means of predicting toxicity to fungi. Petroleum aromatic mixtures containing olefins and saturated hydrocarbons, when processed to establish a relatively high sp. gr. in relation to boiling range were found to have high toxicity values. T. L. R.

Derived Chemical Products.

1864. Fuel Synthesis By-products as a Source of Chemicals. F. W. Sullivan. *Chem. Engng Prog.*, 1947, **43** (12), 13–17.—The Hydrocol process, although developed primarily for the production of liquid fuels from natural gas, is becoming a principal source of many basic organic chemicals. The effect of this production under normal expansion conditions on conventional sources is discussed for acetic, propionic, and butyric acids, for ethyl alcohol, and for other chemicals produced by the process in smaller quantities. J. G. H.

Miscellaneous Products.

1865. New Low Temperature Rubber made by "Anti-freeze" Method. G. G. Oberfell and R. W. Thomas. *Auto. Ind.*, 1948, **99** (2), 44.—The manufacture of chemical rubber in an emulsion "anti-freeze" system employing methanol at a temp. of 14° F, as developed by the Phillips Petroleum Company, is outlined. The new product (known as Philprene "B" to distinguish it from Philprene "A," which is produced at 41° F) affords advantages compared with other synthetic rubbers from the standpoints of tensile strength and recovery of the anti-freeze. J. G. H.

1866. Flow Properties of Pseudo-Plastic Fluids. Part 2. Flow of GR-S Latices in Commercial Tubing. C. C. Winding, W. L. Kranich, and G. P. Baumann. *Chem. Engng Prog.*, 1947, **43** (11), 613–622.—In order to determine whether or no data on apparent and limiting viscosities obtained in capillary viscometers, as indicated in the first paper of the series, might be successfully extrapolated to the prediction of both laminar and turbulent flow in commercial sizes of pipe and tubing, investigations were undertaken on the flow of GR-S latices in tubes of internal diameters ranging from 0·309 to 1·122 in. Results are here reported, and applications to the prediction of flow of pseudo-plastics in general for use in "safe side" design calculations are described. Special studies of the effect of temp, duration, and type of pumping, and excess monomers are also summarized. J. G. H.

Engines and Automotive Equipment.

1867. "Bristol" Proteus Propeller Turbines. Anon. *Mech. World*, 24.9.48, **12**, 343.—These engines include the "free turbine" arrangement, *i.e.*, the propeller and compressor turbines are mechanically separated. Their small diameter allows them to be installed entirely within the main-plane of an aircraft. The Brabazon Mk. II and the S.R. 45 will be powered respectively with eight and ten Proteus engines coupled in pairs. O. M.

1868. New Light Aero Engine. Anon. *Aeroplane*, 22.10.48, **75**, 530.—The Cirrus engine section of Blackburn Aircraft Ltd. have produced a new 180 b.h.p. four-cylinder in-line, air-cooled engine. This unit will be particularly suitable for aircraft of gross weight up to 2800 lb. Technical data are :—

Length	47 in.
Height	31 in.
Width	17 in.
Net dry weight	350 lb.
Max take-off power at sea-level	180 b.h.p. at 2600 r.p.m. and full throttle.
Consumption	13·25 gal/hr.
Max continuous power	158 b.h.p. at 2300 r.p.m.
Consumption	9·75 gal/hr.

I. G. B.

1869. A Fuel Filter for Small Engines. Anon. *Oil Engine & Gas Turbine*, Aug. 1948, **16** (184), 128.—Details are given of a new type of fuel filter, known as the Wipac. The two filter elements, which can be easily cleaned or replaced, consist of four aluminium discs of diaphragm formation, to which are attached the filtering materials. Each disc consists of one layer of fine gauze and one of felt. The filter is specially suited for small engines, the rate of flow being 3¼ gal/hr with a 6-in head of fuel oil. Testing the filter with fuel containing red ochre showed that 2½ oz of the foreign material could be removed before the flow was reduced below the normal working rate. C. D. B.

1870. New Form of Heat Exchanger. Anon. *Oil Engine & Gas Turbine*, Aug. 1948, **16** (184), 130.—A new type of cooling interchanger, known as the Simplato, consists of a pack of copper plates, separated by sealing joints, and clamped between headers by through-bolts. The plates have a series of parallel grooves in each face, the grooves in one face being at right angles to those on the other side which form continuous passages for the fluids passing through the cells, alternate cells being used for the coolant and the hot liquid. The liquids are fed by four marginal slots which communicate with the headers.

A range of these heat exchangers are made to suit engines from 2 to 500 b.h.p. They are suitable for either water-to-water or oil-to-water interchangers, or as combined units for engine-cooling water and lub. oil cooled by the same raw water.

C. D. B.

1871. Boosting Engine Performance with Alcohol–Water Injection. J. C. Porter, W. B. Roth, and R. Wiebe. *Auto. Ind.*, 1948, **98** (8), 34–37.—Initial results are reported of a comprehensive programme for investigating the practical aspects of alcohol–water injection in automobile engines (Crosley, Plymouth, and Chevrolet) and the specific effect of alcohols in the "coolant" mixture. A bibliography of alcohol–water injection, 1913–48, is included. J. G. H.

1872. Automotive Dual-fuel System Saves High Octane Gasoline. R. C. Mack. *Auto. Ind.*, 1948, **98** (3), 36–37.—Recent investigations of potential economies in private-car operation have revealed that high O.N. gasoline is required as only 20% of total fuel consumption. Details are given of an experimental dual-fuel system developed by Socony-Vacuum comprising two separate fuel tanks, lines, pumps, and carburettors — a complete fuel system for each grade of gasoline. Details are given of the method of change from high to low O.N. fuel and of a special carburettor being developed for the investigation. J. G. H.

1873. Knock-Free Engine Operates on Low-octane Gasolines. P. M. Heldt. *Auto. Ind.*, 1948, **98** (2), 32.—Previous work on water–alcohol injection as a detonation-suppressing agent is reviewed, and the problems encountered are enumerated. Details are presented of an injection device known as the Thompson Vita-Meter designed to operate with an anti-detonating fuel composed of water, alcohol, and T.E.L. Performance records are tabulated, and the significance of operating variables is discussed. J. G. H.

1874. Methods for Improving the Quality of Motor Gasoline. N. I. Al'dokhin. *Neft. Khoz.*, 1948 (8), 42–47.—A discussion of U.S.S.R. gasoline standards and of the unfavourable effect on consumption, engine wear, and performance of gasolines with high F.B.P.'s. Attempts had been made to raise the F.B.P. to 260° C in order to increase gasoline yield, but it is pointed out that the increased consumption thus caused more than offsets any yield increases. The standard set by the U.S.S.R. oil industry for 1948 is a gasoline with a 10% point of $\geq$85° C, F.B.P. 210° C max and O.N. 65–70 (with 1·5 ml T.E.L./kg). This specification is criticized as being unsuitable for winter use in the colder parts of the country, and the introduction of a winter grade is urged. V. B.

1875. Diesel Engines and their Fuels. P. N. Everett. *Motor Ship*, Oct. 1948, **29**, 273.—The paper gives an account of the problems associated with different grades of fuels for high- and low-speed machinery. I. G. B.

1876. Recent and Future Diesel Developments. S. Belilove. *Gas Oil Pwr*, 1948, **43**, 263.—The following recent developments are briefly described: (1) cooling-water temperatures of 160–180° F are now common, and if the jacket water is under pressure temperatures of 230° F may be maintained; (2) pressure charging at pressures between 6 and 15 p.s.i. has been tried, but the defects of peak pressure increase and excessive heat production have prevented loadings much above the maximum given by the Büchi system (6 p.s.i.), although higher peak loadings are obtainable for short intervals; (3) dual-fuel engines will burn any proportion of oil–gas from 100% oil to 10% oil + 90% gas, and are so controlled that a change from gas to oil operation is automatic. H. C. E.

1877. Fuel Pumps for Gas Turbines. Anon. *Flight*, 30.9.48, **54**, 411.—This gives a brief account of performance of fuel pumps produced by Dowty Equipment Co. on a 500-hr non-stop test run using petrol. I. G. B.

1878. The Gas Turbine and its Combustion Problems. I. Lubbock and I. G. Bowen. *Motor Ship*, Oct. 1948, **29**, 276.—The authors attempt to relate the influence of liquid fuels on the economics and design of gas turbines for industrial and marine purposes. Combustion equipment is illustrated by designs produced by the Shell Petroleum Co. Ltd., and a brief account is also given of specific applications. I. G. B.

1879. Small American Two-stroke Engine. Anon. *Gas Oil Pwr*, 1948, **43**, 279.—The Lorain engine, a single-cylinder horizontal two-stroke, can readily be adapted to burn diesel oil, butane, or natural gas. It is constructed in two sizes; type L has a 7¼-in × 8-in cyl giving 21 b.h.p. at a top speed of 600 r.p.m., and type O has a 9¼-in × 10-in cyl giving 34 b.h.p. at a top speed of 480 r.p.m. The cast-iron alloy liner is of the wet type, and the cyl is water-cooled throughout its whole length. The Bosch fuel pump is actuated by a chain-driven camshaft. Lubrication is by a combination of force-feed and splash. The cooling system is of the condenser type in which water vapour is condensed in the radiator by forced-draught cooling. H. C. E.

1880. Alfa-Romeo Small Marine Oil Engine. Anon. *Gas Oil Pwr*, 1948, **43**, 280.—The type 430 engine has four 115 mm by 140 mm cyl and a compression ratio of 16 : 1. For marine installations the top output is 55 b.h.p. at 1500 r.p.m.; for land use it develops 78 b.h.p. at 2000 r.p.m. Optimum fuel consumption is 185 g/b.h.p. hr. The complete range of engines comprises five, having top outputs between 55 b.h.p. at 1500 r.p.m. and 160 b.h.p. at 1700 r.p.m. The two smallest models have pre-combustion chambers, and the larger models, of which one is described above, have direct injection. H. C. E.

MISCELLANEOUS.

1881. Growth of World Crude Oil Production. A. Cahen. *Bull. Assoc. franç. Tech. Pétrole*, 1948 (71), 25–45.—A review of world crude-oil production, with especial reference to the U.S.A. position since 1920; illustrated by statistical charts. Figures giving world and U.S.A. reserves are included. The position in the principal producing zones outside the U.S.A. is outlined. V. B.

1882. Insulation Requirements for Oil-industry Motors. P. Hornick. *Oil Gas J.*, 16.9.48, **47** (20), 93.—Materials for motor insulation are divided into three classes. Class A contains organic materials such as paper, silk, and cotton, immersed in a liquid dielectric or treated so that space between fibres is filled with a suitable material.

In practice, the limiting "hottest spot" total temperatures for this class are 90° C by thermometer and 100° C by resistance measurement.

Class B insulation consists of inorganic materials such as fibre glass, mica, and asbestos, and they withstand moisture and chemicals better than Class A materials.

Limiting temperatures in practice are 110° C and 120° C respectively, according to method of measurement.

Class H includes composite insulation materials treated with silicone resins and varnishes, and these are capable of outstanding total temperatures of 300° C for limited periods and have exceptional water- and chemical-resistant properties.

The effect of temperature on insulation is a graded physical deterioration with time, but it is the total temperature which is the final criterion.

The ability of Classes B and H materials to operate at high temperatures makes reduction in size and weight possible, but performance characteristics closely effect design. G. A. C.

1883. Cost of One Brake-Horsepower. W. L. Nelson. *Oil Gas J.*, 9.9.48, **47** (19), 109.—No. 213 in the Refiner's Notebook series gives a table showing type of drive (gas or diesel engine, electric motor, steam pumps, etc.) basic price of fuel power or steam (in cents), properties of fuel, cost (in cents) per b.h.p./hr (2545 B.Th.U.), and efficiency based on heat in basic fuel.

Fuel and lub.-oil consumption is also listed. G. A. C.

BOOK REVIEW.

Chemical Synonyms and Trade Names. W. Gardner and E. I. Cooke. 5th Edition. London: Technical Press Ltd. 1948. Pp. 558. 50*s*.

This book, which is intended to be a dictionary and commercial handbook for the chemist, manufacturer and dealer, contains approximately 28,000 definitions and cross-references. It is well printed on good-quality paper, and is remarkably free from typographical errors. As befits its general character of a dictionary, brief facts only are given under each heading. The cross-reference is thorough and, in general, the data given are sufficient to characterize the product reasonably well.

It is clear that an attempt has been made in this book to cover a wide range of chemical industries and, in particular, the rapid growth of the plastics industry has been taken into account. It is, however, a little difficult to understand why so much material that is out of date has been included. The only reason suggested to justify the inclusion of so much obsolescent material is the rather quaint one that "it is often useful to know those materials that are now unobtainable." This may be true in a minority of cases, but not so when out-of-date products and definitions are given to the exclusion of the present-day ones.

In so far as the petroleum industry is concerned, the treatment is disappointing and inadequate and does not reflect the range and diversity of modern petroleum products and derived chemicals. The unsuspecting reader might infer that the bulk of petroleum products to-day were still obtained from Baku. There are few references to the products of present-day lub.-oil technology, but various antiquated products are included, such as—"Bakurin"—a lub. oil consisting of 100 parts of crude Baku oil, 25 parts of castor oil, and 60–70 parts of sulphuric acid of 66° B. Similarly, motor spirit is defined as: "The saturated aliphatic hydrocarbons of American oil, the polymethylenes from Baku oil, or the unsaturated hydrocarbons derived from Shale oil. . . . They usually have a boiling point below 120° C." When, however, present-day products are described, the information is sometimes misleading; for example, "Paraflow" is described as a synthetic lubricating oil, but no mention is made of its pour point depressant properties.

These criticisms should not be allowed to detract from the very real overall value of the book. He would be a gifted individual indeed who could learn no fresh or valuable fact from "Chemical Synonyms and Trade Names" each time he opened the book.

J. H. P.

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JANUARY, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parenthesis.

Applications for Membership.

ADAMS, William, Research Chemist, Lobitos Oilfields Ltd. (*A. G. V. Berry; Biske*).

BURSTIN, Hugo, Petroleum Technologist. (*L. Ivanovsky; P. H. Frankel*).

DALSTON, Herbert Byron, Fuel Oil Supervisor, Petroleum Board. (*R. J. Bressey; T. C. Bailey*).

FAIR, John Charles, Trainee, British Petroleum Co. of New Zealand Ltd. (*R. B. Southall; P. F. Ellis*).

FFOULKES-JONES, Geoffrey Squire, Geologist, Kern Oil Co. Ltd. (*A. J. Ruthven-Murray; H. V. Lavington*).

FLEMING, Charles L., Chemist, Esso Development Co. Ltd. (*C. S. Windebank; E. B. Evans*).

FULLER, Howard Irwin, Chemist, Esso Development Co. Ltd. (*E. B. Evans; A. Osborn*).

GALLOWAY, Robert Macleod, Analytical Chemist, Shell-Mex and B.P. Ltd. (*F. N. Harrap; G. N. Coles*).

HART, William Frank, Agent for Freedom-Valvoline Oil Co. (*J. M. Marshall; H. Healey*).

HUTCHISON, Stanley John, Student, Chemical Engineering, University of Birmingham. (*F. H. Garner*).

MURRAY, Peter Wood, Lubrication Engineer, Messrs. Colvilles Ltd. (*H. E. Priston; G. E. Everist*).

NEAME, Christopher Hardwicke, Representative, Silvertown Lubricants Ltd. (*L. O. Maskell; W. J. H. Kempton*).

ROBERTSON, William MacGregor Stuart, Assistant Chemist, Anglo-American Oil Co. Ltd. (*J. W. Clarke; R. A. McCarl*).

STEVENS, William Henry, Consulting Chemist. (*H. C. Tett; F. R. Braybrook*).

TURNER, Duncan, Assistant Chemist, Anglo-American Oil Co. Ltd. (*C. Chilvers; E. H. Wild*).

THOMPSON, Ian Joseph, Fuel Technologist, The War Office. (*G. B. Maxwell; H. M. Hurgess*).

VIVIAN, Arthur Cecil, Project Manager, Llandarcy Refinery Expansion, Anglo-Iranian Oil Co. Ltd. (*G. H. Coxon; C. J. Wright*).

WATSON, Arthur Lennox, Chemist, Messrs. Taylor & Son. (*F. Dakin; E. R. Wilson*).

Transfer.

BEVAN, Leslie, Chief Examiner, Ministry of Supply. (*J. Mason; J. R. Wheeler*). (*Member to Fellow*).

HILL, Dennis Stanley, Chief Research Chemist, Messrs. Carless, Capel & Leonard. (*S. J. M. Auld; W. H. Hoffert*). (*Associate Member to Member*).

HUNN, Stanley Alfred Horace, Chief Assistant to Manager, Technical Dept., Eagle Oil & Shipping Co. Ltd. (*R. G. Mitchell; H. Hyams*). (*Associate Member to Fellow*).

SMITH, Norman Wilson, Proprietor of G. Watson Gray. (*W. F. Jelffs; A. T. White*). (*Member to Fellow*).

TADAYON, Jamal, Research Fellow, Chemical Engineering Dept., University of Birmingham. (*F. H. Garner; A. H. Nissan*). (*Student Member to Associate Fellow*).

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-Laws.

As Members.

BILLINGHAM, W. F.
COWLES, M. T.

Transfer to Member.

EVANS, F. N. S.

As Fellows.

RECINE, A. G.
SHATWELL, V. L.
SMITH, J. C.
ZWICKY, M.

Transfer to Fellow.

HAWORTH, A. J.

As Associate Members.

CREAL, N. R.
EVANS, W. E.
LENNIE, D. W.
RIGBY, J. A.
SCALLAN, J. F. P.
SHEEN, R. W.
THOMAS, D. J.
WILDIG, C. A.

As Associate Fellows.

DASHWOOD, J. H. C.
DAWSON, L. S.
FRANCIS, E. A. L.
GODFREE, B. R.
HALL, A. O.
HOLLOWAY, F. E.
JONES, J. W. T.
JONES, V. C. R.
PAGET, R.
PEARCE, T. C.
REID, G.
ROGALA, T. R.
TANNER, Miss E. M.
TAYLOR, J. H.
TYRRELL, E.
WILLIAMSON, G. M.

Transfer to Associate Fellows.

GOODFELLOW, A. J.
DRYER, S. R. C.
METCALF, T. J.

As Student Members.

JONES, L. W.
LESTER, L. J.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

FEBRUARY, 1948.

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The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parenthesis.

Applications for Membership.

BAILEY, Dennis Raymond, Chemist, Shell Petroleum Co. Ltd. (*C. W. G. Martin ; R. I. Lewis*).

BARKER, Lewis Ward, Petroleum Executive, Shell Petroleum Co. Ltd. (*C. W. G. Martin ; R. J. Evans*).

BATEMAN, Percy Rowland, Managing Director, British Alliance Oil Corpn. Ltd. (*S. J. M. Auld ; Sir Alexander McColl*).

BECKMANN, Peter, Senior Chemist, National Oil Pty. Ltd., Glen Davis, N.S.W., Australia. (*G. E. Mapstone ; B. A. Raper*).

BYROM, William, Assistant Manager, Gas & Fuel Oil Dept., Anglo-American Oil Co. Ltd. (*G. M. Davies ; E. W. Hardiman*).

CETTI, Vincent R., Lieut.-Colonel, R.A.S.C. (*J. Mason ; G. B. Maxwell*).

DUEGAN, Bhim Sain, Officer-in-charge, Ordnance Fuel Testing Laboratory, Bombay.

DYSART, Thomas Joseph, Supervisor, Petroleum Board. (*H. F. Jones ; G. M. Davies*).

FLANAGAN, John Livingstone, Fuel Oil Manager, Shell Petroleum Co. Ltd. (*J. A. Oriel ; C. W. G. Martin*).

HUDSON, Norman Leslie, Joint Manager (Fuel Oils), Shell-Mex and B.P. Ltd. (*J. A. Oriel ; G. H. Coxon*).

HULTON, Adam Stephen Campbell, Petroleum Executive, Shell Petroleum Co. Ltd. (*C. W. G. Martin ; D. King-Farlow*).

JOHNN, Cecil Charles William, Technical Representative, Shell Co. of East Africa, Ltd. (*J. A. Oriel ; P. Draper*).

LOCK, Frank Edmund, Chief Engineer, Crosby Valve & Engineering Co. Ltd. (*C. J. Johnson ; E. P. Driscoll*).

MUMFORD, Henry Edward Geoffrey, Assistant Manager, Fuel Oil Dept., Shell Petroleum Co. Ltd. (*J. A. Oriel ; C. W. G. Martin*).

NOLAN, Wilfrid John, Technical Assistant, Shell-Mex and B.P. Ltd. (*F. N. Harrap ; G. L. Coles*).

PERRY, Robert Mackay, Chemist, Shell Petroleum Co. Ltd. (*R. W. J. Smith ; C. Hull*).

TAIT, Thomas, Chemist, Anglo-Iranian Oil Co. Ltd. (*D. A. Howes ; A. E. Dunstan*).

Transfers.

MASON, Herbert James, Executive, Vauxhall Motors Ltd. (*E. A. Evans ; J. C. Cragg*). (*Associate Member to Fellow*).

RAE, Norman Sidney, Chemist, Esso European Laboratories. (*C. S. Windebank ; A. Osborn*). (*From Student Member*).

WILLIAMS, Henry Grafton Stanley, Field Manager. (*C. T. Longcroft ; A. J. Ruthven-Murray*). (*Member to Fellow*).

WINWARD, Antony, Petroleum Technologist, Esso Development Co. Ltd. (*C. S. Windebank ; H. L. West*). (*From Student Member*).

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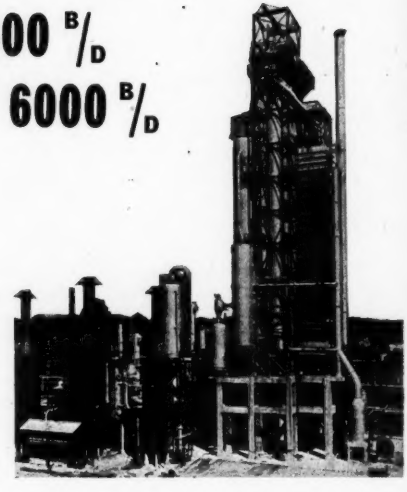

Lion Oil cat cracker accepted after 28 days initial run...

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78 Mount Street, London, W.1

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

MARCH, 1948.

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The names of candidates' proposers and seconders are given in parenthesis.

Applications for Membership.

ABOLFATHI, A., Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

AGHDAEY, A., Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

BAXTER, John Walter, Civil Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

BESLEY, Richard Bradfield, General Services Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. L. Black; H. W. Fleming*).

BOLANDI, R. A., Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

BURDON, Harold Michael, Operator, Anglo-Iranian Oil Co. Ltd., Abadan.

BURGESS, Theodore Basil, Captain, R.A.S.C. (Petroleum Technical Training Centre, Llandarcy). (*T. M. Simmons; E. J. Horley*).

CARBY, Sydney Richard, Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

CARTER, Christopher Thomas, Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

CARTWRIGHT, William Robert, Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

COLES, Kenneth Frank, Senior Physical Chemist, Petrocarbon Ltd. (*R. Sefton; F. Morton*).

CRAWFORD, Fergus McIntosh, Acting Drilling Supt., U.B.O.T. Ltd. (*J. E. Smith; F. C. Hamilton*).

DAVIES, Michael Harold, Works Chemist, British Bituminous Emulsions Ltd. (*G. W. D. Holmes; A. M. Hepworth*).

DAWSON, Ernest John, Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy; J. L. Black*).

DEAN, Joel, Technical Assistant, Anglo-Iranian Oil Co. Ltd. (*G. E. Wheeler; J. G. Withers.*)

DICKENS, Frank Pogson, Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

ELLIS, Stanley Edward, Trainee Plant Chemist, "Shell" Refining & Marketing Co. Ltd. (*H. W. Fleming; J. L. Black*).

FAINT, William Ernest, Deputy Manager, Lub. Oil Pool, Manchester Region, Anglo-American Oil Co. Ltd. (*J. E. Haslam; E. J. Dunstan*).

FARNELL, Charles Frederick, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

GARDNER, Harry, Chemist, "Shell" Refining & Marketing Co. Ltd. (*J. Parrish; W. R. P. Hodgson*).

GHODSI, A. M., Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

GREEN, Frank, Assistant Manager, Shell-Mex and B.P. Ltd. (*T. T. Davies; H. E. Priston*).

GREGG, Sydney Horatio, Mechanical Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

HARDCASTLE, Barry, Office Engineer, U.B.O.T. Ltd. (*H. L. Lyne; K. G. Tait*).

HAWKINS, Lawrence Hugh Cecil, Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

HOLLOWOOD, William, Senior Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

HORAN, Alan James, Student, Petroleum Production Engineer, Birmingham University. (*F. H. Garner*).

HUNT, Walter Davidson, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

JACKSON, George, Acting Chief Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

JOHNSON, Leslie William, Managing Director, The Forward Oil Co. Ltd. (*P. H. Snow; W. Blackwell*).

KAMALI, J., Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

KIRSTEIN, Wouter, Instructor, Bahrein Petroleum Co. Ltd. (*N. E. Watson; E. H. T. Walker*).

LAMB, John, Chief Marine Supt., Anglo-Saxon Petroleum Co. Ltd. (*J. A. Oriel; R. I. Lewis*).

LAVERICK, William Arthur, Acting Chief Engineer, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy; J. L. Black*).

LAWSON, Alfred Horace, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

LAYZELL, Peter Graham, Chemist, Shell-Mex and B.P. Ltd. (*T. T. Davies; D. L. Samuel*).

LEAHY, Denis Thomas, Chemist, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

LOUDON, Alexander, General Plant Technologist, "Shell" Refining & Marketing Co. Ltd. (*L. Belchetz; J. L. Black*).

LOYND, George William, Assistant Plant Chemist, "Shell" Refining & Marketing Co. Ltd. (*H. W. Fleming; J. L. Black*).

LYDER, Wilfred Dempster, Field Engineer, Antilles Petroleum Co. (*P. E. T. O'Connor; F. K. Worsley*).

MACARTNEY, Richard Joseph, Chairman & Managing Director, Macartney Ltd. (*T. Tipler; R. St. A. Griffiths*).

MANEFFA, Mario, Student, Petroleum Production Engineering, Birmingham University. (*F. H. Garner*).

MASTERSON, Thomas Christopher, Student, Petroleum Production Engineering, Birmingham University. (*F. H. Garner*).

MURRANT, James Edwin, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

OSTOVAR, M., Assistant Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

OWERS, Arthur Leonard, Assistant Buyer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

RAPSON, Harry David Coleman, Chemist, Vacuum Oil Co. Ltd. (*S. J. M. Auld; D. M. Duckworth*).

ROACH, William Henry Gordon, Chief Engineer, William Press & Son. (*F. Tipler; R. St. A. Griffiths*).

SAJJADI, S., Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

SCORER, John David Thomas, Student, Petroleum Production Engineering, Birmingham University. (*F. H. Garner*).

SMITH, Derrick Strang, Materials Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

SMITH, John Nesbitt, Mechanical Engineer, Shell-Mex and B.P. Ltd. (*E. Evans-Jones; R. St. A. Griffiths*).

SMITH, Michael Ian, Trainee Works Chemist, Shell Petroleum Co. Ltd. (*H. W. Fleming; J. L. Black*).

SORAAS, Erling, Chief Chemist, Norsk Amerikansk Mineraloljecompagni, Vallo. (*K. T. Arter; A. Osborn*).

TWISS, Robert George, Captain, R.A.S.C. (Petroleum Technical Training Centre, Llandarcy). (*T. M. Simmons; J. H. C. Dashwood*).

WRIGHT, Harold Richard Tasker, Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*).

YASSERI, A., Chemist, Anglo-Iranian Oil Co. Ltd., Abadan. (*K. B. Ross; B. D. Cauthery*).

Transfer.

CAMERON, Alexander Bryce, Manager, Trinidad Northern Areas Ltd. (*F. H. Garner; D. A. Howes*). (*Associate Member to Fellow*).

EDWARDS, Kenneth Ward, Junior Exploitation Engineer, U.B.O.T. Ltd. (*J. E. Smith; D. J. O'Donoghue*). (*Student Member to Associate Fellow*).

FLEMING, Howard William, Assistant Refinery Manager, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy; J. L. Black*). (*Member to Fellow*).

GOTTESMANN, Manfred, Representative in Palestine of Raven Oil Co. Ltd. (*Associate Member to Member*).

GRUNBERG, Leander, Senior Research Chemist, Dr. Rosin Industrial Research Co. Ltd. (*F. H. Garner; A. H. Nissan*). (*Associate Member to Fellow*).

SHAW, George Bernard, Industrial Dept. Manager, Marine & Industrial Lubricants Ltd. (*G. W. D'Arcy-Evans; H. Y. Mosey*). (*Associate Member to Member*).

SPENCE, Huntly Gordon, Lubrication Engineer, Berry Wiggins & Co. Ltd. (*N. L. Anfilogoff; R. C. Paterson*). (*Student Member to Associate Fellow*).

YONGE, Dudley Arthur, Technological Assistant, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert*). (*Member to Fellow*).

THE INSTITUTE OF PETROLEUM.

AT the Annual General Meeting of the Corporate Members of the Institute of Petroleum to be held at the Royal Society of Arts on April 30, 1948, at 4.30 p.m., consideration will be given to and, if thought fit, the necessary resolution or resolutions will be passed for the alteration of certain existing By-Laws of the Institute.

A copy of the existing By-Laws and of the proposed alterations to these By-Laws are available for inspection by any member during normal business hours, and will continue to be so available until the Annual General Meeting is held for adopting these proposed amendments to the By-Laws.

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

APRIL, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ANDREW, Ian Chisholm, Director, London Oil Refining Co. Ltd. (*J. E. Haslam ; E. J. Dunstan*).

ARDEN, George Douglas, Power Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

ATKINS, James Nicholas, Assistant to Power Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

BEAMAN, William Harold, Assistant Departmental Manager, Shell Petroleum Co. Ltd. (*R. S. Teale ; E. L. Bass*).

BOULTREE, Arthur Hallam, Manager, Research and Development, Shell Oil Company (loaned to "Shell" Refining & Marketing Co. Ltd.). (*E. LeQ. Herbert ; J. L. Black*).

BOXALL, Wilfred, Assistant Works Chemist, Shell Petroleum Co. Ltd. (*E. J. Dunstan ; N. A. Clegg*).

BOYLE, Frederick David, Senior Tester, Manchester Oil Refinery Ltd. (*G. H. Harries ; E. S. Sellers*).

BROOKS, James, Chemical Engineer, Manchester Oil Refinery Ltd. (*E. S. Sellers ; G. H. Harries*).

BROWNLEE, Richard Paton, Technical Chemist, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

CHAPMAN, John, Chemical Plants Supervisor, Petroleum Inventions Ltd. (*N. A. Clegg ; R. Levi*).

CHURCH, John, Technical Engineer, Texas Oil Co. Ltd. (*W. A. Webster ; A. J. Featherstone*).

CLARK, Charles Raymond, Assistant Departmental Manager, Shell Petroleum Co. Ltd. (*R. S. Teale ; E. L. Bass*).

CLARKE, Arthur Eric, Sales Director, Spurrier, Glazebrook & Co. Ltd. (*E. J. Dunstan ; N. A. Clegg*).

COMRIE, Alan Richard, Assistant Works Manager, Anglo-Iranian Oil Co. Ltd., Melbourne. (*A. R. Stark ; R. C. Thomson*).

COPPEN, Barbara Phyllis, Assistant Experimental Officer, Ministry of Supply. (*G. Kinner ; H. M. L. Wardle*).

CROWE, Albert William, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; E. L. Bass*).

DOTCHIN, James, Assistant Chief of Technical Division of Lubricants Dept., Shell Petroleum Co. Ltd. (*R. S. Teale ; E. L. Bass*).

EHRSTROM, Anders Robert Joachim, Assistant Chief Chemist, Osakeyhtio Nobel-Standard Aktiebolag. (*A. A. Wuorela ; A. Osborn*).

EVANS, Arthur William, Senior Engine Operator, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; C. G. Williams*).

ENGLE, Albert, Lubricating Oil Manager, Shell Petroleum Co. Ltd. (*J. A. Oriel ; F. L. Garton*).

FERGUSON, Andrew Archibald, Assistant Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*A. Wilson ; C. D. Brewer*).

FORBES, Andrew Glenne, Refinery Chief Chemist, Anglo-Iranian Oil Co. Ltd. (*F. H. Garner ; G. Noble*).

FORSYTH, Eric, Chemical Engineer, Manchester Oil Refinery Ltd. (*E. S. Sellers ; G. H. Harries*).

FULTON, William Sneddon, Supervisor, Trinidad Leaseholds Ltd, Trinidad. (*F. Morton ; B. G. Banks*).

GINN, Robert James, Technical Representative, Anglo-American Oil Co. Ltd. (*C. Chilvers ; T. C. G. Thorpe*).

GREEN, Raymond George, Chemist, "Shell" Refining & Marketing Co. Ltd. (*J. Parrish ; P. G. Higgs*).

HARDWICK, John Farrar, Chemist, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy ; H. W. Fleming*).

HODGKINSON, George, Chief Chemist, James Light & Son, Ltd. (*I. Barr Adams ; V. L. Farthing*).

IZARD, Leonard James, Mechanical Engineer, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

JENKINS, Thomas Francis, Stores Superintendent, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

JENKINS, William George Haydn, Development Chemist, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

Knowles, Ernest, Works Chemist, London Oil Refining Co. Ltd. (*J. E. Haslam ; E. J. Dunstan*).

LAPITZKY, Maurice M., House Engineer, "Shell" Refining & Marketing Co. Ltd. (*W. R. P. Hodgson ; J. Parrish*).

LEE, Ray Arthur Framingham, Assistant Development Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

LLOYD, Richard, Managing Director, Lubricine Oil Co. Ltd. (*E. R. Redgrove ; R. J. S. Perry*).

LOCKWOOD, Norman, Senior Engine Operator, "Shell" Refining & Marketing Co. Ltd. (*C. G. Williams ; C. D. Brewer*).

MACLEOD, Norman Whittaker, Senior Engine Operator, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; C. G. Williams*).

MCMAHON, John William, Technical Adviser, C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg*).

MCPHERSON, Gilbert, Consulting Engineer, Selection Trust Ltd. (*T. Muir Warden ; A. J. Ruthven-Murray*).

MASTERS, Percival Charles, Head of Distribution Operations, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; G. H. Harries*).

MUIRHEAD, Michael Yohane, Development Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

OGDEN, Harry, Chief Draughtsman, Manchester Oil Refinery Ltd. (*J. Rennet Thomson ; E. S. Sellers*).

ONIONS, James Beaconsfield, Chief Inspecting Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

ORMAN, Peter Laurence, Research Physicist, "Shell" Refining & Marketing Co. Ltd. (*A. Wilson ; C. D. Brewer*).

PAGE, Howard Morgan, Section Superintendent, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

PANTER, Frank Arthur, Control Laboratory Supervisor, Manchester Oil Refinery Ltd. (*G. H. Harries ; E. S. Sellers*).

PERRY, Archibald Laurence Hillyer, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

PITTMAN, Walter Hanley, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

PORGES, Frederick Benjamin, in charge of Development, Solvent Refining Processes, Petrocarbon Ltd. (*E. J. Dunstan ; E. S. Sellers*).

POTT, Wilfred, Company Director, Spurrier, Glazebrook & Co. Ltd. (*E. J. Dunstan ; N. A. Clegg*).

PRICE, George Owen, Development Chemist, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

QUAYLE, Ernest, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

RACKSTRAW, Frank Lloyd, Engineering Assistant, Iraq Petroleum Co. Ltd. (*Y. P. Wilson ; G. D. Pounder*).

RATCLIFFE, Claude Talbot Gorry, Development Chemist, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

SCHNURMANN, Robert, Chief Physicist, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; G. H. Harries*).

SCHOFIELD, John Albert, Manager, Balmer, Lawrie & Co. Ltd, Calcutta. (*C. W. J. Biddolph*).

SCHUBERT, Thomas, Administrative Assistant, Anglo-Iranian Oil Co. Ltd. (*W. H. Thomas ; G. M. Williamson*).

SHAW, Alan Heaton, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

SIMPSON, Charles Abercrombie, Chartered Accountant, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

SMITH, Alan Christer, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

SNELL, Walter Anthony, Assistant Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*C. D. Brewer ; A. Wilson*).

STOKER, William Richard, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

TAIT, Douglas Alexander, Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*H. W. Fleming ; J. L. Black*).

TURNER, Robert Joseph, Manager, Industrial Oils Dept., C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg*).

USMAR, Gordon Graham, Assistant Lubricating Manager, Anglo-American Oil Co. Ltd. (*E. R. Wilson ; W. G. Peacock*).

VAILE, Philip Edward Burdock, Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*A. Wilson ; C. D. Brewer*).

VENABLES, Leslie Goward, Technical Assistant, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

WADSWORTH, Frank Alastair, Mechanical Engineer, Shell Petroleum Co. Ltd. (*R. S. Teale ; T. M. Taylor*).

WILLIMENT, John William, Technical Assistant, Shell Petroleum Co. Ltd. (*R. S. Teale ; E. L. Bass*).

Transfer.

DAVIES, Thomas Trevor, Deputy Manager, Shell-Mex and B. P. Ltd: (*A. H. Stephinson ; R. W. J. Smith*). (*Associate Member to Fellow*).

GRAY, George Edward, Chemist & Technical Director, Silene Lubricants Ltd. (*G. J. Vineall ; V. M. Farrant*). (*Associate Member to Fellow*).

JAMES, John Edmund, Chief Chemist, Snowdon, Sons & Co. Ltd. (*E. R. Redgrove ; R. J. S. Perry*). (*Member to Fellow*).

KIND, Franz, Managing Director, Petrocarbon Ltd. and Petrochemicals Ltd. (*E. J. Dunstan ; G. H. Harries*). (*Member to Fellow*).

WILLIAMS, Harold Derek, Senior Examiner, Minister of Supply. (*J. Mason ; L. Bevan*). (*Associate Member to Associate Fellow*).

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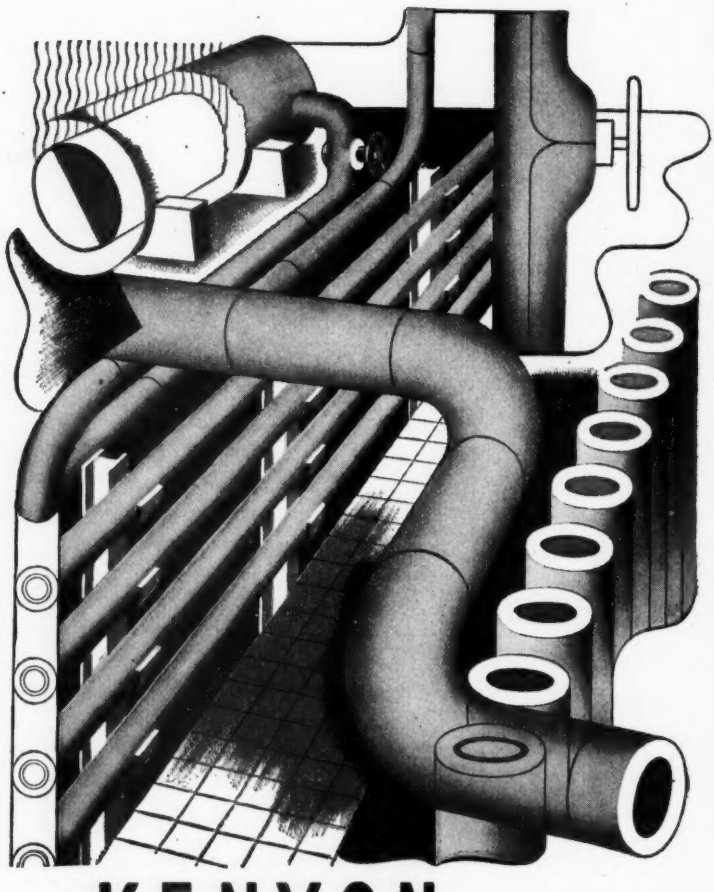

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

MAY, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ARSCOTT, Joseph William, Pipeline Superintendent, United British Oilfields of Trinidad Ltd. (*J. Grant ; J. E. Smith*).

BAILEY, James Raymond, Trainee Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

BERRIMAN, John Alexander, Chief Technologist, Shell Haven Refinery. (*S. G. Wraight ; G. F. Hazzard*).

BOTTOMLEY, Edwin, Chemist, C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg*).

BRANDLER, John Howard, Assistant to Managing Directors, Petrocarbon Limited. (*E. J. Dunstan ; F. Kind*).

BRISCOE-KNIGHT, Aubrey Wilton, Industrial Sales Engineer, Anglo-American Oil Co. Ltd. (*A. Osborn ; A. J. F. Kenyon*).

BRITTON, Alan, Office Engineer, Shell Co. of Venezuela Ltd. (*J. Williams ; W. Mackay*).

BROOKS, Eric, Assistant Operator, Anglo-Iranian Oil Co. Ltd, Abadan. (*B. D. Cauthery ; D. N. McKinlay*).

CARROLL, William, Chief Technical Assistant, Laidlaw, Drew & Co. Ltd. (*T. C. Bailey ; R. J. Bressey*).

CHATTING, Arthur Harold, Electrical & Instrumentation Engineer, E. B. Badger & Sons (G.B.) Ltd. (*C. Paysant ; T. W. Muncaster*).

CONNOLLY, Charles Herbert, Flight-Lieutenant (Tech.E.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

CRAWFORD, Edmund Robert, Trainee Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

CUMMINGS, Carl E., Superintendent, Beacon Laboratories, The Texas Company. (*D. A. Shepard ; F. H. Garner*).

DOBSON, Harold, Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

EDWARDS, Laurence MacKenzie, Trainee Chemist, Shell Petroleum Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

FROOZANI, Darab, Assistant Chemist, Anglo-Iranian Oil Co. Ltd, Abadan. (*K. B. Ross ; B. D. Cauthery*).

GARNER, Philip James, Associate Director of Research, "Shell" Refining & Marketing Co. Ltd. (*D. Morten ; C. D. Brewer*).

GLENDINNING, Leslie, In charge of production of Soluble Oils, C. C. Wakefield & Co. Ltd. (*E. A. Evans ; H. H. Ballard*).

GRAHAM, Arthur, Lubrication Sales Executive, Silvertown Lubricants Ltd. (*J. A. Bennett ; L. O. Maskell*).

HAGGER, Michael James, Assistant Technologist, "Shell" Refining & Marketing Co. Ltd. (*G. F. Hazzard ; S. G. Wraight*).

HALTER, George Edward, Refinery Maintenance Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

HARDING, Royston Albert, Squadron Leader (Tech.E.) Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

HARROP, Gordon, Company Secretary, Ranson Grease Co. Ltd. (*T. W. Ranson ; Mervyn Mason*).

HAWKER, Arnold McNab, Director, Simmons & Hawker Ltd. (*F. Tipler ; J. A. Griffiths*).

HAWKES, Herbert Lewis, Technical Sales Representative, British Transformer Oil & Lubricants Ltd. (*E. J. Dunstan ; N. A. Clegg*).

HOCKNELL, William, Assistant Refinery Technologist, "Shell" Refining & Marketing Co. Ltd. (*G. F. Hazzard ; S. G. Wraight*).

HOLDEN, Richard William, Flight Lieutenant (Tech.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

JENKINS, Ronald Osborn, Refinery Accountant, "Shell" Refining & Marketing Co. Ltd. (*G. F. Hazzard ; S. G. Wraight*).

KERR, Archibald Campbell, Squadron Leader (Tech.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

LODWICK, John Rhys, Chemist, Anglo-Iranian Oil Co. Ltd. (*A. R. Stark ; W. Newby*).

MACARTHUR, Ian Charles, Assistant Engineer, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; J. G. Withers*).

MARSHALL, Wilfrid Frank, Test Engineer, Manchester Oil Refinery, Ltd. (*N. A. Clegg ; G. H. Harries*).

MONKS, John Matthew, Trainee Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

MOSS, Roland, Works Manager, British Solvent Oils Ltd. (*E. J. Dunstan ; N. A. Clegg*).

NISBET, Frank, Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

PATERSON, Thomas, Product Development Chemist, Vacuum Oil Co. Ltd. (*S. J. M. Auld ; E. G. Ellis*).

PEARSON, Robert Cosme, Engineer, United British Oilfields of Trinidad, Ltd. (*F. A. D. Griffiths ; W. H. Berry*).

PENDER, Ian Allan Burnett, Trainee Works Chemist, "Shell" Refining & Marketing Co, Ltd. (*S. G. Wraight ; G. F. Hazzard*).

PRENTICE, William Ross, Plant Technologist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

REDFERN, John Mackenzie, Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

ROYCROFT, Thomas George, Flight Officer (Tech. E.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

DE RYCKERE, Paul R., Sales Manager, The Texas Company, S.A.B.,Brussels. (*H. Weiser ; P. H. Raines*).

SKERRETT, Norman Philip, Chief Chemist, United British Oilfields of Trinidad, Ltd. (*T. A. Dent ; J. Grant*).

STAMMERS, Cyril Victor, Squadron Leader (Tech.E.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

STOREY, Benjamin Lawson, Engineer, Trinidad Leaseholds Limited. (*N. R. Pocock ; J. H. McLea*).

SWEENEY, Francis Joseph, Trainee Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

VASSIE, Eustace Robert, Laboratory Assistant, "Shell" Refining & Marketing Co. Ltd. (*G. F. Hazzard ; S. G. Wraight*).

WALKER-ARNOTT, David Athelton, Flight Officer (Tech.E.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

WALLIS, Stanley William James, Deputy Superintendent, Control Instrument Dept., Anglo-Iranian Oil Co. Ltd. (*C. E. Spearing, M. A. L. Banks*).

WARD, Arthur Henry, Squadron Leader (Tech.E.), Royal Air Force. (*R. B. Southall ; P. F. Ellis*).

WEBSTER, Dennis, Assistant Engineer, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

WILDEN, Thomas William, District Manager, Anglo-American Oil Co. Ltd. (*E. J. Dunstan ; E. S. Scorgie*).

WILLIAMS, Lionel John, Refinery Works Chemist, "Shell" Refining & Marketing Co. Ltd. (*S. G. Wraight ; G. F. Hazzard*).

Applications for Transfer.

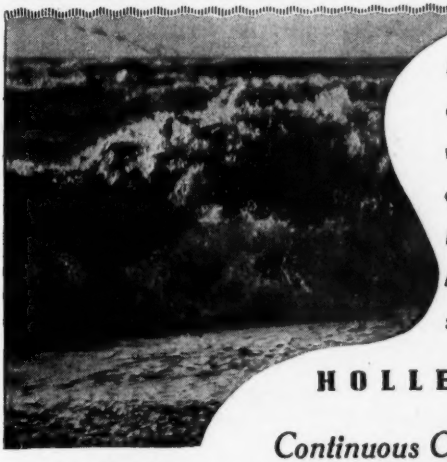
CARR, George Clifford, Chief Engineer, Eagle Oil & Shipping Co. Ltd. (*R. G. Mitchell ; S. A. Hunn*). (*Member to Fellow*).

GROSS, Walter Glenn, Project Engineer, "Shell" Refining & Marketing Co. Ltd. (*B. S. Brailey ; J. A. Morrison*). (*Associate Member to Fellow*).

MOORE, Charles Frederick Carre, Oilfield Technologist, Attock Oil Co. Ltd. (*E. S. Pinfold ; N. F. Brown*). (*Associate Member to Fellow*).

THOMAS, David William, Treatments Superintendent, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*). (*Associate Member to Member*).

CONTINUOUS WASHING



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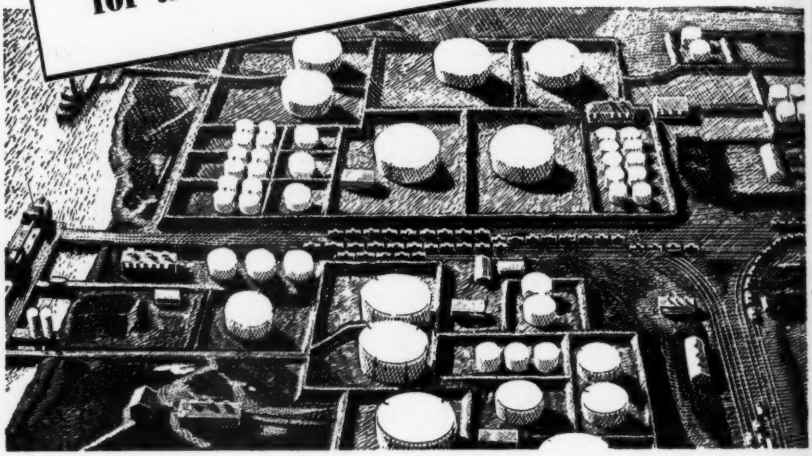

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JUNE, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BARTLEY, Charles Arthur John, Managing Director, C. J. Bartley & Co. Ltd. (*F. Tipler ; R. St A. Griffiths*).

CAFFAREY, James George, Assistant Manager, Shell-Mex & B.P. Ltd. (*J. A. Oriel ; H. Hyams*).

COLERIDGE, Thomas Travers Newton, Technical Adviser, Shell Co. of New Zealand Ltd. (*M. L. H. Stewart ; F. L. Garton*).

COPUS, Christopher Mansell, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

CUDDINGTON, Kenneth Shephard, Assistant Chemist, Anglo-Iranian Oil Co. Ltd. (*T. Tait ; W. H. Thomas*).

DAVIES, John Alastair, Petroleum Installation Engineer, Shell Co. of The Sudan Ltd.

FAHEY, Roderick Vincent, Petroleum Production Superintendent, Antilles Petroleum Co. Ltd. (*P. E. T. O'Connor ; F. C. Hamilton*).

FIELD, Hugh William, General Manager, Research & Development Dept., Atlantic Refining Co. (*T. G. Delbridge ; J. Bennett Hill*).

GALLOWAY, Donald Frederick, Director of Research, Production Engineering Research Association of Great Britain. (*N. L. Anfilogoff ; A. H. Dodd*).

GROVE, Ronald Garfield, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

HICKINBOTTOM, Wilfred John, University Reader in Organic Chemistry, Queen Mary College, London, E.1. (*F. H. Garner ; F. Morton*).

HICKLING, Wilfred Ernest, Director, Germ Lubricants Ltd. (*J. E. Southcombe ; J. C. Wood-Mallock*).

HOBSON, Henry Carrington, Tool Pusher, Apex (Trinidad) Oilfields Ltd. (*L. A. Bushe ; M. A. Rust*).

HOOKINS, Leonard Alfred, Engineer, Industrial Oil Dept., C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; Mervyn Mason*).

KANGELIDIS, Lazaros H., Manager, Lubricating Oil Dept., Steaua Romana, Istanbul. (*R. B. Southall ; E. J. Horley*).

KIRKLAND, James, Trainee Exploitation Engineer, United British Oilfields of Trinidad Ltd. (*J. E. Smith ; D. J. O'Donoghue*).

LLOYD, Alan Richard, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

MATHIAS, Thomas William, Managing Director, Colas Products Ltd. (*J. A. Oriel ; C. F. Jackson*).

MITCHELL, Francis Poulton, Engineer, Shell-Mex B.P. Ltd. (*A. H. Stephenson ; F. Tipler*).

PACKHAM, Leonard George, Manager, Overseas Division (Branches Dept.), C. C. Wakefield & Co. Ltd. (*G. H. Thornley ; J. C. Cragg*).

PARKER, Mrs. Winifred Lucy, Senior Examiner in charge of Lubricants Laboratory, A.I.D. Test House, Ministry of Supply. (*J. Mason ; L. Bevan.*)

PEACE, Joseph Anthony, Fuel Oil Representative, Anglo-American Oil Co. Ltd. (*G. M. Davies ; E. W. Hardiman*).

PHILLIPS, Clifford Kenneth, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

ROBERTS, Herbert George, Director, W. H. Willcox & Co. Ltd. (*F. Dakin ; R. Low*).

ROBINSON, Eric Scott, Chemist, Barton Installation, Shell-Mex & B.P. Ltd. (*T. T. Davies ; F. Green*).

SALES, John James Kitchener, Technical Adviser, Shell Co. of South Africa Ltd. (*I. H. G. Nicholson*).

SHOPLAND, Percy George, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

SKINNER, Richard Relf, Shift Laboratory Chargehand, "Shell" Refining & Marketing Co. Ltd. (*G. F. Hazzard ; S. G. Wraight*).

SMALE, Norman Edwin, Chief Engineer, Wayne Tank and Pump Co. Ltd. (*C. W. Wood ; C. T. Barber*).

STEDMAN, Brian John, Office Engineer, United British Oilfields of Trinidad Ltd. (*F. C. Hamilton ; P. A. Taylor*).

STEED, Cyril Ernest, Personal Assistant to Director, Fina Petroleum Products Ltd. (*A. J. Wilson ; S. S. Bush*).

SUMMERS, Leslie Irwin, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

THETFORD, Stephen Aveling, Circuit Manager, Redline-Glico Ltd. (*F. Dallow ; E. R. Wilson*).

THOMAS, Eric Marsden, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

TIMOTHY, William Charles, Installation Supervisor, Shell-Mex & B.P. Ltd. (*T. T. Davies ; F. Green*).

WALLACH, Frederick Charles, Director, Sterns Ltd. (*W. C. F. McCarthy ; H. L. Wallach*).

WEBLEY, Eric John Martin, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

WILKINS, Derek Foster, Draughtsman (Mech.), Anglo-American Oil Co. Ltd. (*J. Lindsay ; J. I. G. Elsden*).

WOOD, Norman Edward, Chief Inspector, "Shell" Refining & Marketing Co. Ltd. (*J. L. Black ; H. W. Fleming*).

ZEHTABIAN, Ali, Student Apprentice Process Operator, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley*).

Applications for Transfer.

BERRY, Leonard William, Assistant General Manager, Lobitos Oilfields Ltd. (*A. T. Beazley ; J. S. Parker*). (*Associate Member to Fellow*).

EDWARDS, Stanley Haines, Laboratory Manager, Shell Co. of New Zealand Ltd., Wellington, N.Z. (*L. F. Elsby ; W. R. P. Hodgson*). (*Member to Fellow*).

FARMER, Michael Henry, Assistant in Technical Administration, Anglo-Iranian Oil Co. Ltd. (*T. Tait ; W. H. Thomas*). (*Student Member to Associate Fellow*).

GOLDSTEIN, Richard Frank, Deputy Development Manager, The British Oxygen Co. Ltd. (*K. Gordon ; C. W. Wood*). (*Associate Member to Fellow*).

HALL, Frederick John Spencer, Managing Director & Chief Chemist, Horton Manufacturing Co. Ltd. (*E. A. Evans ; S. J. M. Auld*). (*Member to Fellow*).

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-Laws.

As Members.

Barker, L. W.
Bateman, P. R.
Billingham, W. F.
Cowles, M. T.
Faint, W. E.
Flanagan, J. L.
Hogarth, W. G.
Hudson, N. L.
Johnson, L. W.
Lock, F. E.
Merrick, C. M.
Mumford, H. E. G.
Nolan, W. J.
Platt, J. W.
Sansom, H. W.
Scriven, A. E.

Transfer to Member.

Charlesworth, P. A.
Evans, F. N. S.

As Fellows.

Burstin, Hugo.
Carter, C. T.
Cartwright, W. R.
Ffoulkes-Jones, G. S.
Gardner, N.
Jackson, C. F.
Lamb, J.
Laverick, W. A.
Macartney, R. J.
Pohl, W.
Recine, A. G.
Roach, W. H. G.
Shatwell, V. L.
Smith, J. C.
Soraas, E.
Street, R. H.
Tait, T.
Vivian, A. C.
Zwicky, M.

Transfer to Fellow.

Bevan, L.
Cameron, A. B.
Fleming, H. W.
Grunberg, L.
Haworth, A. J.
Hazzard, G. F.
Kind, F.
Mason, H. J.
Smith, N. W.
Williams, H. G. S.
Wilson, A. J.
Yonge, D. A.

As Associate Members.

Andrews, D.
Bandfield, C. A.
Burgess, J. R.
Creal, N. R.
Drury, G. N.
Dysart, T. J.
Evans, W. E.
Fair, J. C.
Gibson, P. D.
Hart, W. F.
Hulton, A. S. C.
Kirstein, W.
Lennie, D. W.
Lyder, W. D.
Mason, T. F.
Murray, P. W.
Neame, C. H.
Owers, A. L.
Plowman, H. L.
Rigby, J. A.
Robertson, W. M. S.
Scallan, J. F. P.
Sheen, R. W.
Thomas, D. J.
Thompson, I. J.
Trawford, A. J.
Wildig, C. A.

As Associate Fellows.

Abolfathi, A.
Adams, W.
Aghdaey, A.
Bailey, D. R.
Baxter, J. W.
Beckman, P.
Besley, R. B.
Bolandi, R. A.
Buck, F. R.
Burgess, T. B.
Byrom, W.
Carby, S. R.
Cetti, V. R.
Clarke, R. A.
Coats, W. L.
Coles, K. F.
Crawford, F. M.
Dalston, H. B.
Dashwood, J. H. C.
Davies, M. H.
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Dawson, L. S.
Dean, J.
Dickens, F. P.
Duegan, B. S.
Engel, S.
Farnell, C. F.
Fleming, C. L., Junr.
Francis, E. A. L.
Fuller, H. I.
Galloway, R. M.
Ghodsi, A. M.
Godfree, B. R.
Green, F.
Gregg, S. H.
Hall, A. O.
Hardcastle, B.
Hawkins, L. H. C.
Holloway, F. E.
Hollowood, W.
Hunt, W. D.
Jackson, G.
Johnn, C. C. W.
Jones, J. W. T.
Jones, V. C. R.
Kamali, J.
Kennedy, G. T.
Lawson, A. H.
Layzell, P. G.
Leahy, D. T.
Louden, A.
Loynd, G. W.
Murrant, J. E.
Oke, E. P. C.
Ostovar, M.
Paget, R.
Pearce, T. C.
Perry, R. M.
Rapson, H. D. C.
Reid, G.
Richards, T. C.
Roberts, D. L.
Togala, T. R.
Sajjadi, S.
Singh, N.
Smith, D. S.
Smith, J. N.
Smith, M. I.
Stevens, W. H.
Tanner, Miss E. M.
Taylor, J. H.
Turner, D.
Twiss, R. G.
Tyrrell, E.
Williamson, G. M.
Wright, H. R. T.

Transfer to Associate Fellow.

Dryer, S. R. C.
Edwards, K. W.
Goodfellow, A. J.
Hill, D. S.
Hunn, S. A. H.
Metcalf, T. J.
Rae, N. S.
Spence, H. G.
Tadayon, J.
Winward, A.

As Student Members.

Ellis, S. E.
Griffiths, T. H.
Horan, A. J.
Hutchinson, S. J.
Jones, L. W.
Lester, L. J.
Maneffa, M.
Masterson, T. C.
Palmer, J. S.
Rintoul, C. J. V.
Scorer, J. D. T.
Thorley, B.
Walmsley, P. J.
Watson, A. L.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

JULY, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ABEL, Edward, Engineer-in-charge, Workshops, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy; H. W. Fleming.*)

BAMFORD, Ivor James, Technical Representative in Italy for Anglo-Iranian Oil Co. Ltd. (*M. A. L. Banks; D. G. Smith.*)

BEXON, Roger, Assistant Geologist, Trinidad Petroleum Development Co. Ltd. (*C. C. Wilson; J. S. Collcott.*)

BRIX, Vladimir Herbert, Research Engineer, Rolls Royce Ltd. (*A. W. Pottier; G. H. Harries.*)

DE CHASTELAIN, Alfred George Gardyne, Managing Director, Griffin Industrial Development & Trading Co. Ltd. (*G. Elias; C. M. Leitch.*)

CLOUGH, Harry, Section Manager, Imperial Chemical Industries Ltd. (*E. R. H. Davies; E. G. Brown.*)

DERRY, Leonard Dodd, Research Engineer, Esso Development Co. Ltd. (*C. S. Windebank; E. B. Evans.*)

DOBBS, Sheriff Sandal, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

FISHER, John Moodie, Chief Engineering Draughtsman, United British Oilfields of Trinidad Ltd. (*J. E. Smith; J. W. Arscott.*)

FRANKLIN, Reginald John, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

GIBBS, Kenneth Reginald, Mechanical Engineer, Shell Oil Company. (*S. E. Coomber; G. D. Hobson.*)

GODFREY, Michael Wanless, Exploitation Engineer, Cia Petroleo Shell de Colombia. (*G. S. Taitt; L. C. Stevens.*)

GOODACRE, Charles Lindsay, Technical Assistant, Associated Ethyl Co. Ltd. (*F. R. Banks; W. E. J. Broom.*)

HARE, Arthur Charles, Assistant Civil Engineer, Consolidated Refineries Ltd. (*S. G. Tidy; E. C. Johnson.*)

HAYMAN, David Alan, Chemist, Shell-Mex & B.P. Ltd. (*T. T. Davies; P. G. Layzell.*)

JOHNSTON, George Swarbrick, Head Stillman, Anglo-Egyptian Oilfields Ltd. (*H. A. Blackmore; L. H. Cooper.*)

JORDAN, Godfrey David, Lubrication Engineer, Messrs. S. Fox & Co. Ltd.

KARLBOM, Nils Gunnar Richard, Senior Technical Executive, Svenska Petroleum AB. Standard. (*H. C. Tett; C. Chilvers.*)

KENDALL, Norman, Senior Research Engineer, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; C. D. Brewer.*)

LEWIS, Owen Calder, Technical Engineer, Shell Company of South Africa Ltd. (*I. H. G. Nicholson.*)

LLOYD, Charles Herbert, Mechanical Engineering Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*J. A. Oriel; E. LeQ. Herbert.*)

MACWILLIAM, John, Chief Engineer, Scottish Oils Ltd. (*R. Crichton; J. G. Annan.*)

MOULE, Harry Jack, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

NORRISH, Ronald George Wreyford, Professor of Physical Chemistry, University of Cambridge. (*A. E. Dunstan; C. E. Spearing.*)

PARTON, Stanley, Technical Representative, Shell-Mex & B.P. Ltd. (*G. E. Everist; S. J. Crawshaw.*)

PATTENDEN, Samuel Philip, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

RANDALL, Alan James, Tester, "Shell" Refining & Marketing Co. Ltd. (*D. H. Japes; N. Cohen.*)

RODDAN, Matthew, Assistant Divisional Manager, Shell-Mex & B.P. Ltd. (*R. J. Bressey; G. Richardson.*)

SCOTT, Elgin Friderik, Drilling Superintendent, Trinidad Petroleum Development Co. Ltd. (*C. C. Wilson; J. S. Collcott.*)

SEHEULT, Evar, Production Engineer, Apex (Trinidad) Oilfields Ltd. (*H. W. Reid; R. A. Maclachlan.*)

SHAWYER, Adrian Charles, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

SIMMONDS, Harold Sidney, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

SNOW, Geoffrey Russell, Technologist, Eclipsol Oil Co. Ltd. (*P. H. Snow: A. R. Bowen.*)

TIGG, Thomas Hugh, Refinery Technologist, Anglo-Egyptian Oilfields Ltd. (*G. F. Hazzard; S. G. Wraight.*)

VIGNOLES, Charles Malcolm, Manager Eastern Division, Shell Petroleum Co. Ltd. (*J. A. Oriel; H. Hyams.*)

WOOLVEN, Charles George, Flight Lieutenant on Petroleum Quality Control Officers' Course, National Oil Refineries Ltd. (*R. B. Southall; P. F. Ellis.*)

Transfer.

KYLE, William Galloway, Sales Engineer, British Mexican Petroleum Co. Ltd. (*F. H. Garner; E. W. Hardiman.*) (*Associate Member to Associate Fellow.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

Clarke, A. E.	McMahon, J. W.	Simpson, C. A.
Lloyd, R.	Pott, W.	Turner, R. J.

As Fellows.

Arden, G. D.	Brownlee, R. P.	Forbes, A. G.
Beaman, W. H.	Dotchin, J.	Porges, F. B.
Boultbee, A. H.	Engle, A.	Schnurmann, R.

Transfer to Fellow.

Davies, T. T.	James, J. E.	Kind, F.

As Associate Members.

Andrew, I. C.	Evans, A. W.	Onions, J. B.
Boxall, W.	Jenkins, T. F.	Pittman, W. H.
Boyle, F. D.	Lockwood, N.	Schofield, J. S.
Chapman, J.	Macleod, N. W.	Usmar, G. G.
Church, J.	Masters, P. C.	Williment, J. W.
Crowe, A. W.	McPherson, G.	

As Associate Fellows.

Atkins, J. N.
Brooks, J.
Comrie, A. R.
Ehrstrom, A. R. J.
Ferguson, A. A.
Forsyth, E.
Fulton, W. S.
Ginn, R. J.
Green, R. G.
Hardwick, J. F.
Hodgkinson, G.
Izard, L. J.
Jenkins, W. G. H.
Knowles, E.
Lapitzky, M. M.
Lee, R. A. F.
Muirhead, M. Y.
Ogden, H.
Orman, P. L.
Page, H. M.
Panter, F. A.
Perry, A. L. H.
Price, G. O.
Quayle, E.
Rackstraw, F. L.
Ratcliffe, C. T. G.
Schubert, T.
Shaw, A. H.
Smith, A. C.
Snell, W. A.
Stoker, W. R.
Tait, D. A.
Vaile, P. E. B.
Venables, L. G.
Wadsworth, F. A.

Transfer to Associate Fellow.

Williams, H. D.

As Student Member.

Coppen, Miss B. P.

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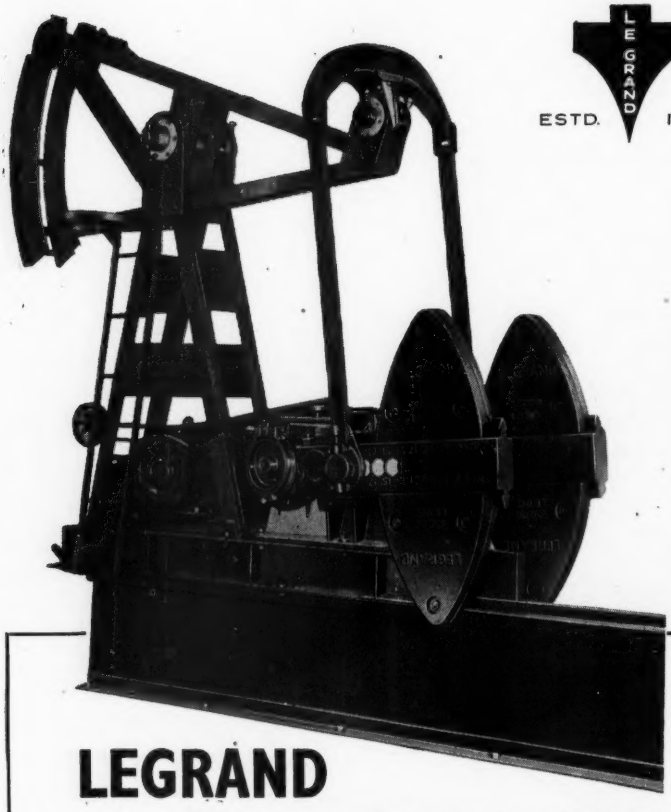

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

AUGUST, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BATTERSBY, James Samuel, Executive, British Petroleum Co. of New Zealand Ltd. (*W. M. Hurrell ; G. H. Coxon*).

FORTESCUE, Sydney John, General Manager, National Mining Corpn. Ltd, Trinidad. (*P. E. T. O'Connor ; H. C. H. Thomas*).

GALE, Charles Sidney, Senior Engineer, Iraq Petroleum Co. Ltd. (*D. Glynn Jones ; F. R. S. Henson*).

RENDALL, Eric, Fuel Oil Supervisor, Shell-Mex and B.P. Ltd. (*R. J. Bressey ; T. C. Bailey*).

ROSS, Ralston Kennedy Cameron, Assistant Buyer, "Shell" Refining & Marketing Co. Ltd. (*J. W. Reid ; E. LeQ. Herbert*).

SINCLAIR, Duncan Paterson Kerr, Technical Assistant, Vacuum Oil Co. of South Africa Ltd. (*J. W. Tyler ; W. H. Higham*).

STARLING, John Wilfred, Exploitation Engineer, United British Oilfields of Trinidad Ltd. (*F. C. Hamilton ; J. E. Smith*).

TATE, Alexander, Engineer, Kuwait Oil Co. Ltd. (*C. A. P. Southwell ; J. Mulhern*).

WESTHORP, Roland, Chief Engineer, Fuel Oil Distribution, Stevinson, Hardy & Co., Ltd. (*G. J. Gollin ; N. L. Hudson*).

Transfer.

MOUNTFORD, Lawrence Almeric, Shell Petroleum Co. Ltd. (*J. A. Oriel ; E. L. Bass*). (*Student Member to Associate Member*).

PYRAH, Alan Frederick, Operating Foreman, Bahrein Petroleum Co. Ltd. (*R. Godfrey ; C. Simkins*). (*Associate Member to Fellow*).

NEW MEMBERS

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

Caffarey, J. G.	Hickling, W. E.	de Ryckere, P. R.
Clark, C. R.	Kangelidis, L. K.	Smale, N. E.
Galloway, D. F.	Packham, L. G.	Wallis, S. W. J.
Graham, A.	Roberts, H. G.	

As Fellows.

Coleridge, T. T. N.
Cummings, C. E.
Field, H. W.
Garner, P. J.
Hickinbottom, W. J.
Mathias, T. W.
Nisbet, F.
Skerrett, N. R.

Transfer to Fellow.

Berry, L. W.
Carr, G. C.
Goldstein, R. F.
Gross, W. G.

As Associate Members.

Arscott, J. W.
Bottomley, E.
Brandler, J. H.
Briscoe-Knight, A. W.
Connolly, C. N.
Fahey, R. V.
Glendinning, L.
Halter, G. E.
Harding, R. A.
Harrop, G.
Hawker, A. M.
Hawkes, H. L.
Hobson, H. C.
Holden, R. W.
Hookins, L. A.
Jenkins, R. O.
Kerr, A. C.
Marshall, W. F.
Mitchell, F. P.
Moss, R.
Peace, J. A.
Pearson, R. C.
Roycroft, I. G.
Skinner, R. R.
Stammers, C. V.
Stedman, B. J.
Steed, C. E.
Storey, B. L.
Thetford, S. A.
Timothy, W. C.
Vassie, E. R.
Walker-Arnott, D. A.
Ward, A. H.
Wilden, T. W.

As Associate Fellows.

Bailey, J. R.
Berriman, J. A.
Britton, A.
Carroll, W.
Chatting, A. H.
Cuddington, K. S.
Davies, J. A.
Dobson, H.
Froozani, D.
Hocknell, W.
Kirkland, J.
Lodwick, J. R.
Macarthur, I. C.
Monks, J. M.
Parker, Mrs. W. L.
Paterson, T.
Pender, I. A. B.
Prentice, W. R.
Redfern, J. M.
Sales, J. J. K.
Williams, L. J.
Wood, N. E.

Transfer to Associate Fellow.

Farmer, M. H.
Thomas, D. W.

As Student Members.

Brooks, E.
Copus, C. M.
Crawford, E. R.
Edwards, L. M.
Grove, R. G.
Hagger, M. J.
Lloyd, A. R.
Phillips, C. K.
Robinson, E. S.
Shopland, P. G.
Summers, L. I.
Thomas, E. M.
Webley, E. J. M.
Wilkins, D. F.
Zehtabian, A.

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

SEPTEMBER, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BEVAN, Henry George Moore, Mechanical Engineer, Texas Petroleum Co. (*J. S. Parker ; A. Cluer.*)

BRADLEY, John Ward, Works Chemist, Liverpool Storage Co. Ltd. (*A. Watson ; F. Dakin.*)

BRYANT, Kenneth Conrad, Research Chemist, Trinidad Leaseholds Ltd. (*F. Morton ; R. Sefton.*)

CARPENTER, Peter Rudolph, Laboratory Technician, R.A.F. Petroleum Laboratory. (*W. Johnson ; F. Holloway.*)

CAWLEY, Charles Mills, Deputy Chief Chemist, Department of Scientific and Industrial Research. (*F. H. Garner ; A. E. Dunstan.*)

CHRISPIN, Donald, Sales Director, Wm. Walker & Sons (Hanley) Ltd. (*T. H. Matthews ; E. Thornton.*)

DILLEY, Guy Surtees, Drilling Superintendent, Anglo-Egyptian Oilfields Ltd. (*H. E. F. Pracy ; A. W. W. Kirby.*)

FARQUHAR, John Churchill, Technical Advisor, Shell Company of South Africa Ltd. (*I. H. G. Nicholson.*)

FOSTER, Alfred James, Manager, Traffic and Stocks Dept., Shell-Mex & B.P. Ltd. (*H. Hyams ; J. W. Vincent.*)

JARMAN, Edward, in charge of General Engineering Division, Kuwait Oil Co. Ltd. (*C. A. P. Southwell ; E. C. Masterson.*)

JOHNSON, Lawrence Charles, Laboratory Technician, R.A.F. Petroleum Laboratory. (*W. Johnson ; F. Holloway.*)

LAWRENCE, Frederick, Senior Technical Engineer, Shell-Mex & B.P. Ltd. (*W. S. Ault ; H. E. Priston.*)

LYNN, David Crawford, Supervising Engineer, Combustions Ltd. (*G. M. Davies ; W. Byrom.*)

MITCHELL, Clive Dingley, Proprietor, Mitchell Oil Co. Ltd. (*P. H. Snow ; S. F. Snow.*)

MOODY, Ronald Eric, Chemical Analyst, Manchester Oil Refinery Ltd. (*G. H. Harries.*)

MOUNTENEY, George K., Petroleum Engineer.

ROBERTS, Robert Langford, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*D. J. Pull ; E. LeQ. Herbert.*)

SARP, Osman, Chemist, Shell Company of Turkey Ltd. (*L. H. Cooper ; R. E. Hales.*)

TAYLOR, Betty Louise, Chemist, Eclipsol Oil Co. Ltd. (*P. H. Snow ; W. Blackwell.*)

THOMPSON, Cecil, Installation Engineer, Shell Company of China Ltd. (*J. Wilson ; H. G. B. Perry.*)

WILSON, Brian Sydney, Student, University of Birmingham. (*F. H. Garner.*)

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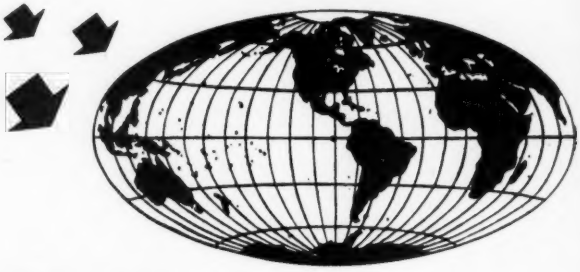

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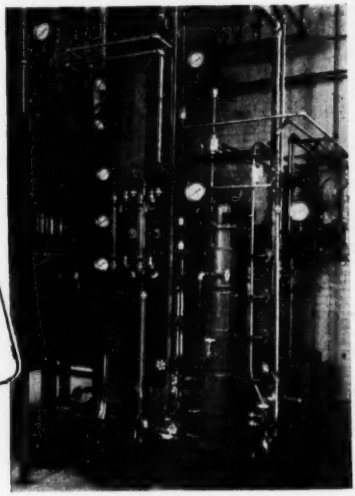

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

OCTOBER, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

DABELL, John Pierce, Drilling Engineer, Sudan Government. (*A. F. Dabell ; R. M. Fletcher.*)

DALE, George Murray, Field Engineer, Equador Oilfields Ltd. (*A. S. Fincham ; A. H. Baldwin.*)

LACK, Hubert Christopher, Refinery Engineer, Foster Wheeler Ltd. (*E. C. Masterson ; G. Elias.*)

MOTE, Lionel John Bowen, Chief Librarian, "Shell" Refining & Marketing Co. Ltd. (*C. G. Williams ; L. F. Elsby.*)

MOODY, Ronald Eric, Chemist, Manchester Oil Refinery Ltd. (*G. H. Harries ; E. J. Dunstan.*)

POTTER, Leslie Allen, Lubricants Representative, Shell-Mex and B.P. Ltd. (*H. E. Priston ; G. E. Everest.*)

POWER, Edward Bertrand, Instrument Engineer, "Shell" Refining & Marketing Co. Ltd. (*P. M. Griffiths ; D. A. Yonge.*)

ROBERTS, Eric George, Lubricants Supervisor, Shell-Mex and B.P. Ltd. (*H. E. Priston ; G. E. Everest.*)

ROBERTS, Robert Langford, Plant Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*D. N. Pull ; E. le Q. Herbert.*)

SANDERSON, John Joseph, Engineer Draughtsman, Shell Chemical Plant Ltd. (*D. J. Pull ; E. Le Q. Herbert.*)

SAUL, Thomas Scott, Chief Buyer, Petrocarbon Ltd. (*E. S. Sellers ; H. K. Whalley.*)

STRADLING, John Malgwyn, Fuel Efficiency Engineer, National Oil Refineries Ltd. (*R. B. Southall ; E. J. Horley.*)

TAYLOR, Cyril John, Cost Accountant, Anglo-Iranian Oil Co. Ltd. (*M. A. L. Banks ; D. G. Smith.*)

TAYLOR, Kenneth Herbert, Assistant Foreman, Messrs. W. F. Smallman & Son. (*P. H. Snow ; W. Blainwell.*)

TAYLOR, Wilford Bramwell, Control Supervisor, Consolidated Refineries Ltd. (*R. C. Cox ; E. H. Ettlinger.*)

WATTS, Bernard Henry, Petroleum Production Engineer, Burmah Oil Co. (Burma Concessions) Ltd. (*J. Coates ; R. Nisbet.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

Abel, E. Vignoles, C. M. Wallach, F. C.

As Fellows.

Bamford, I. J. Norrish, R. G. W.

Transfer to Fellow.

Moore, C. F. C.

As Associate Members.

Bartley, C. A. J.
Charles, A. C.
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Gibbs, K. R.
Parton, S.
Pattenden, S. P.
Scheult, E.
Shawyer, A. G.
Simmonds, H. S.
Swarbrick, J. G.

As Associate Fellows.

Brix, V. H.
Clough, H.
Derry, L. D.
Fisher, J. M.
Godfrey, M. W.
Goodacre, O. L.
Jordan, C. D.
Kendall, N.
Lewis, O. C.
Lloyd, C. H.
MacWilliam, J.
Roddan, M.
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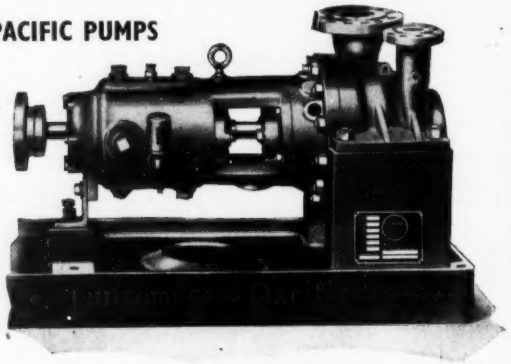

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APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

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The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

ALDRICK, Maurice John, Manager, Anglo-American Oil Co. Ltd. (*A. Osborn ; H. L. West.*)

ANDREWS, John Leslie, Production Manager, Sarawak Oilfields Ltd. (*H. E. F. Pracy ; F. L. Garton.*)

BEGG, Arthur James, Student, Birmingham University.

BILLINGTON, John, Laboratory Assistant, Anglo-American Oil Co. Ltd. (*H. G. Macdonald ; E. Choppen.*)

CAMPBELL, George Stanley, Technical Engineer, Vacuum Oil Co. Ltd. (*H. Y. Mosey ; G. B. Shaw.*)

CHEYNE, James Gordon, Draughtsman, "Shell" Refining & Marketing Co. Ltd. (*D. J. Pull ; E. Le Q. Herbert.*)

CHIR, Vincent Joseph, Lubricating Oil Blending Plant Supervisor, Berry, Wiggins & Co. Ltd. (*J. B. Christian ; R. C. Paterson*).

EASTY, Arthur Victor, Plant Superintendent, Manchester Oil Refinery Ltd. (*E. J. Dunstan ; E. S. Sellers.*)

FOY, Leonard James, Assistant Chief Chemist, The Vigzol Oil Refining Co. Ltd. (*S. Elliman ; J. Romney.*)

GOODGER, Eric Martin, Assistant Engineer, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; E. F. Coxon.*)

GREEN, Austin John, Chemist, Skefko Ball Bearing Co. Ltd., Luton. (*S. J. M. Auld ; E. G. Ellis.*)

HORTON, Graham Michael Brian, Engine Operator, Trinidad Leaseholds Ltd. (*F. Morton ; R. Sefton.*)

HOWE, Herbert Arthur, Student, Birmingham University. (*F. H. Garner.*)

KAPOOR, Bal Raj, Manager, Turner, Hoare & Co. Ltd. (Bombay). *N. L.* (*Anfilogoff ; J. L. Taylor.*)

LATTER, Ralph William, Chief Analytical Chemist, London Transport Executive. (*A. T. Wilford ; W. Davey.*)

MACKENZIE, Kenneth John, Engineering Assistant, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; E. F. Coxon.*)

RUSHWORTH, George Edward, Chief Chemist, British Petroleum Co. of New Zealand Ltd. (*T. Tait ; R. Stansfield.*)

RUTISHAUSER, Leslie Frederick, Research Assistant, Esso European Laboratories. (*E. B. Evans ; A. M. Davies.*)

SCOPES, Lancelot, Divisional Fuel Oil Supervisor, Shell-Mex & B.P. Ltd. (*R. J. Bressey ; G. R. Llewellyn.*)

TRAFFORD, Edward Le Marchant, Chief Exploitation Engineer, Anglo-Egyptian Oilfields Ltd. (*P. N. D. Porter ; J. L. Gaynor.*)

TURNER, Roy, Assistant Chemist, Anglo-Iranian Oil Co. Ltd. (*W. H. Thomas ; A. R. Javes.*)

Transfers.

BURGESS, Major Henry Marshal, Petroleum Engineer, S.T. 2, War Office. (*G. B. Maxwell ; J. R. Burgess.*) (*Associate Member to Associate Fellow.*)

CURRAN, Bernard Reginald, Company Director, Curran Oils Ltd. (*H. Moore ; P. H. Moore.*) (*Associate Member to Member.*)

DICKIE, Robert Kelso, Petroleum Engineer, Anglo-Iranian Oil Co. Ltd. (*D. Comins ; N. F. Brown.*) (*Associate Member to Fellow.*)

HYDE, John Welford, Chemical Engineer, Anglo-Iranian Oil Co. Ltd. (*J. H. Dove ; W. H. Thomas.*) (*Associate Member to Fellow.*)

RAIT, Frank Percy, Managing Director, Percy & Halden Ltd. (*N. L. Skilling ; F. Dakin.*) (*Associate Member to Member.*)

SEYMOUR WALKER, Kay John, Assistant Engineer, Anglo-Iranian Oil Co. Ltd. (*R. Stansfield ; E. F. Coxon.*) (*Student to Associate Fellow.*)

NEW MEMBERS

The following elections have been made by the Council in accordance with the By-laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

Andrew, I. C. Fortescue, S. J. Scott, E. F.

As Fellow.

Karlbom, N. G. R.

Transfer to Fellow.

Hall, F. J. S.

As Associate Members.

Battersby, J. S. Gale, C. S. Rendall, E.
Cameron-Ross, P. K. Mountford, L. A.

As Associate Fellows.

Starling, J. W. Sweeney, F. J. Tate, A.

As Member Companies.

Apex (Trinidad) Oilfields Ltd.
Associated Ethyl Co. Ltd.
Attock Oil Co. Ltd.
Messrs. Barks Williams.
British Controlled Oilfields Ltd.
Messrs. R. S. Clare & Co. Ltd.
Messrs. Dawnays Ltd.
Messrs. G. A. Harvey & Co. Ltd.
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Trinidad Petroleum Development Co. Ltd.
Universe Petroleum Co. Ltd.
Messrs. Woodfield, Hoist Co. Ltd.

ELECTION TO COUNCIL.

The attention of members of the Institute is directed to the following extracts from the By-Laws governing election to the Council of the Institute :—

72. Each and every Corporate Member may nominate in writing a Corporate Member for election as a Member of Council. . . . A nomination to be valid must be signed by at least six other Corporate Members and must be received by the Secretary not later than the thirty-first day of December in any year. No member may sign more than one such Nomination Paper at any one election. . . .

APPLICATIONS FOR MEMBERSHIP OR TRANSFER.

DECEMBER, 1948.

The following have applied for admission or transfer to the Institute. In accordance with the By-laws, the proposals will not be considered until the lapse of at least one month after the publication of this *Journal*, during which time any Fellow, Member, or Associate Member may communicate by letter to the Secretary, for the confidential information of the Council, any particulars he may possess respecting the qualifications or suitability of the candidate.

The object of this information is to assist the Council in grading the candidate according to the class of membership.

The names of candidates' proposers and seconders are given in parentheses.

Applications for Membership.

BALLANTYNE, Robert Ewing Craig, General Sales Manager, William E. Farmer Ltd. (*N. W. Grey.*)

BASKER, Geoffrey Randall, Student, Birmingham University. (*F. G. Garner ; P. Kerr.*)

BETTS, George Gordon, Student, Birmingham University. (*F. H. Garner.*)

BREMNER, Douglas Bruce, Assistant Chief Engineer, Iraq Petroleum Co. Ltd. (*G. W. Dunkley ; S. J. M. Auld.*)

GOALEN, George Kirk, Divisional Manager, Anglo-American Oil Co. Ltd. (*H. MacArthur ; F. P. Rait.*)

HUTCHINSON, Sidney Grafton, Inspecting Engineer. (*S. L. Witard ; L. S. Dawson.*)

HUGILL, Archie James, Student, Birmingham University. (*F. H. Garner.*)

HAWES, Frederick, Driller, Trinidad Petroleum Development Co. Ltd. (*H. A. Bennett ; H. Gilmour.*)

HESLOP, Douglas James, Fuel Engineer, Ministry of Fuel and Power. (*F. M. Garner ; R. H. G. Sutton.*)

INNES, George Love, Assistant Lubricating Manager, Anglo-American Oil Co. Ltd. (*H. MacArthur ; F. P. Rait.*)

KEMP, Cyril Armitage, Assistant Lubricating Manager, Anglo-American Oil Co. Ltd. (*F. Dakin ; N. L. Skilling.*)

LEE, George Anthony, Student, Birmingham University. (*F. H. Garner ; P. Kerr.*)

MACKINTOSH, Catherine Florence Macdonald, Manchester Oil Refinery Ltd. (*F. Kind ; E. J. Dunstan.*)

MAKOWSKI, Jacek, Student, Birmingham University. (*F. H. Garner.*)

MARTIN, Arthur George, Representative, Manchester Oil Refinery Ltd. (*H. Paton ; E. J. Dunstan.*)

MARTIN, Frederick William, Deputy Chief Chemist, Berry Wiggins & Co. Ltd. (*A. Evans ; R. C. Paterson.*)

MOHTADI, Farhang, Research Student, Birmingham University. (*F. H. Garner.*)

PEDRICK, Frederick Verdun, Distribution Clerk, Anglo-Iranian Oil Co. Ltd. (*O. G. Bell ; W. A. Partridge.*)

PHILLIPS, Hayward, Installation Manager, "Shell" Refining & Marketing Co. Ltd. (*H. E. F. Pracy.*)

PUGH, Frank Henry, Lecturer, N.V. de Bataafsche Petroleum Mij. (*F. L. Garton ; J. A. Oriel.*)

ROSS, William Crawford, Senior Shift Chemist, British Celanese Ltd. (*E. Forsyth.*)

STEWART, Francis, Refinery Plant Supervisor, Shell Petroleum Co. Ltd. (*H. F. Wilkinson.*)

STINEAR, Bruce Harry, Petroleum Technologist, Bureau of Mineral Resources, Melbourne. (*H. Temple Watts ; A. Wade.*)

TAYLOR, James Reuben, Superintendent, Regent Oil Co. Ltd. (*N. G. Gullick.*)

TURNER, Ernest Edward, Technical Adviser, Anglo-American Oil Co. Ltd. (*H. C. Tett ; S. J. M. Auld.*)

WHEELER, Lionel Jack, Secretary, Royal Dutch/Shell Group Packaging Committee. (*A. Harland ; J. R. G. Barnes.*)

WILSON, Peter Sutherland, Assistant Chemist, Anglo-Iranian Oil Co. Ltd. (*W. H. Thomas ; P. Fleming.*)

Transfers.

CHATTERLEY, Leslie George, Agent, Messrs. Freedom-Valvoline Oil Co. (*H. Healey ; H. Daintith.*) (*Associate Member to Member.*)

DRIVER, Anthony Victor, Assistant Mechanical Engineer, Shell-Mex and B.P. Ltd. (*H. E. Priston ; W. Pohl.*) (*Student to Associate Fellow.*)

LEVERY, Douglas John, Analytical Chemist, E. D. Worringham & Co. Ltd. (*F. L. Bassett ; J. T. Hill.*) (*Associate Member to Fellow.*)

MCLAUGHLIN, Michael L., Technical Sales Assistant, Irish-American Oil Co. Ltd. (*C. Chilvers ; E. Wild.*) (*Associate Member to Associate Fellow.*)

O'CONNOR, Philip Emmet Taaffe, General Manager, Antilles Petroleum Co. Ltd. (*F. A. Hamilton ; H. W. Reid.*) (*Associate Member to Fellow.*)

WESTON, Reginald Alfred, Oil Superintendent, Cargo Superintendents (Ldn.) Ltd. (*R. A. Weston ; F. A. Ostler.*) (*Associate Member to Member.*)

NEW MEMBERS.

The following elections have been made by the Council in accordance with the By-Laws.

Elections are subject to confirmation in accordance with the By-laws.

As Members.

Taylor, C. J.

As Associate Members.

Dabell, J. B.
Dale, G. M.
Mote, L. J. B.
Potter, L. A.
Roberts, E. G.

As Associate Fellows.

Power, E. B.
Stradling, M. J.
Taylor, W. B.
Watts, B. H.

As Member Companies.

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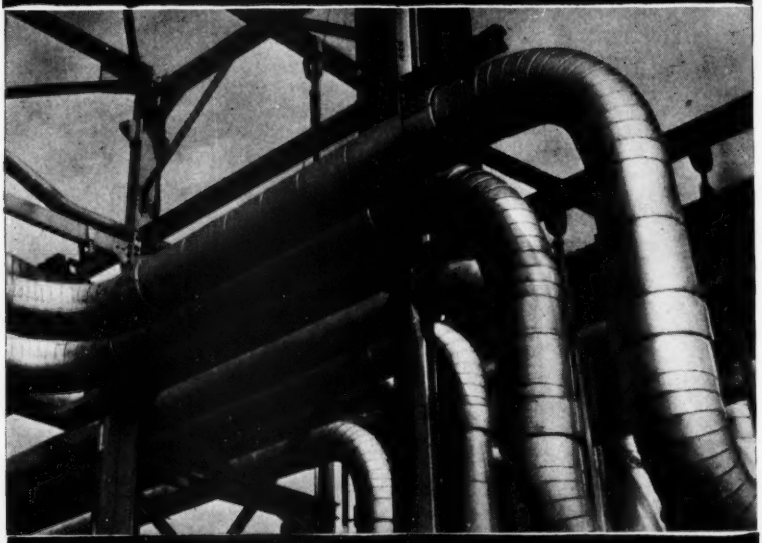

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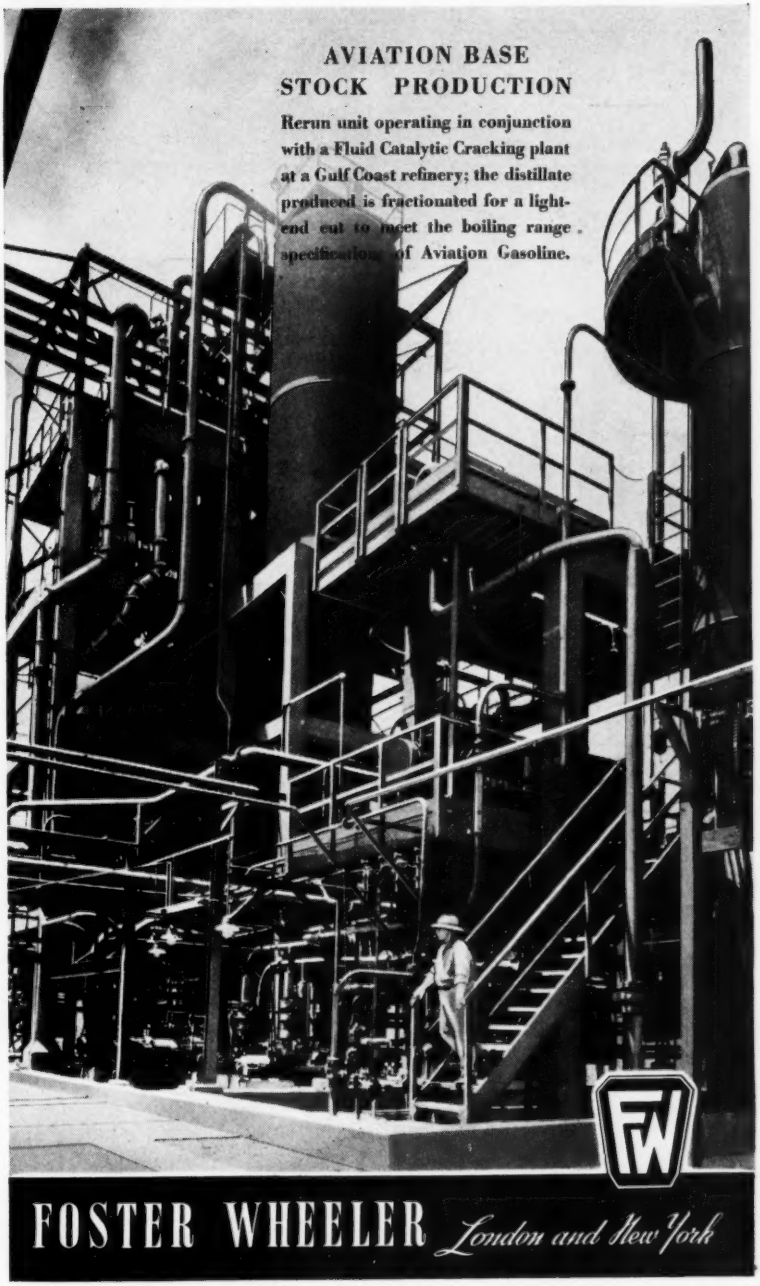
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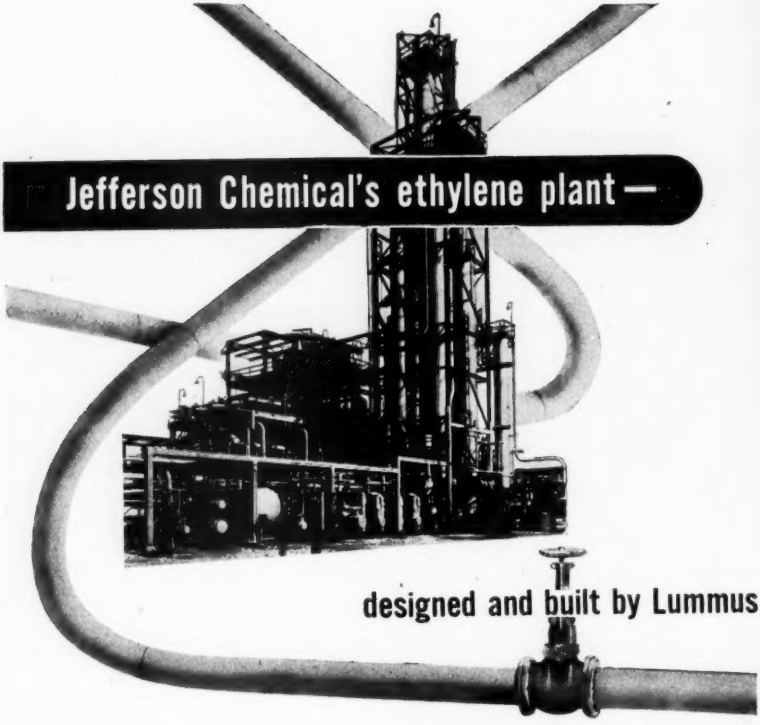

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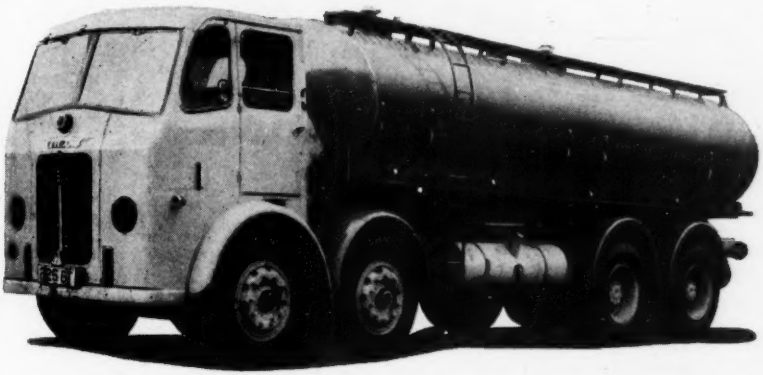

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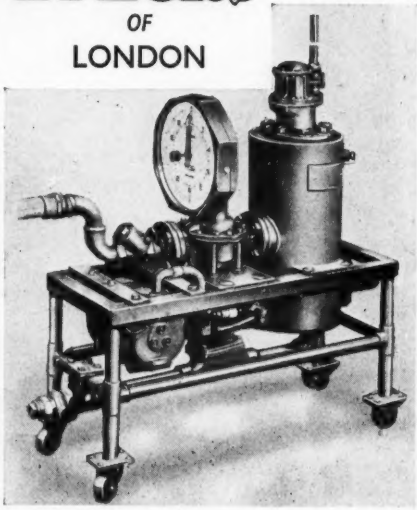

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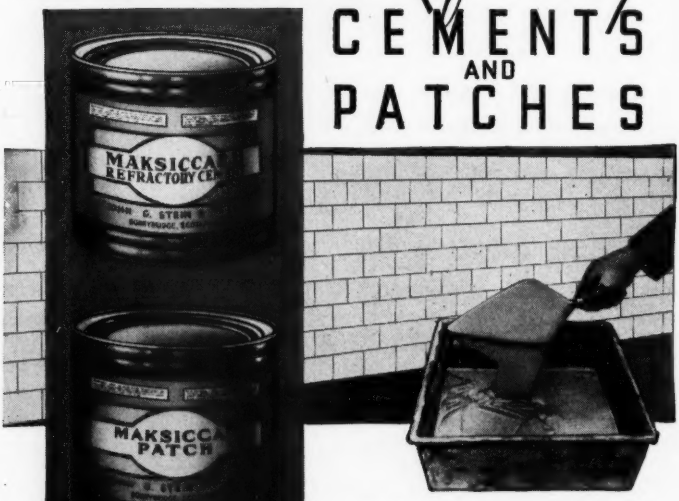

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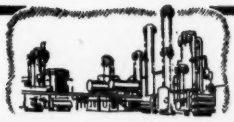

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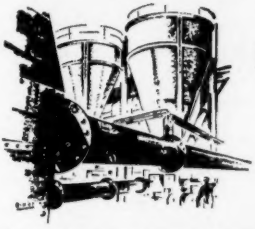

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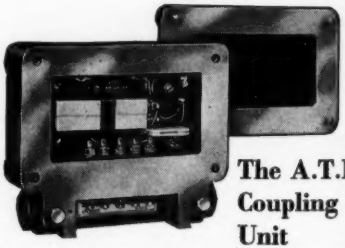

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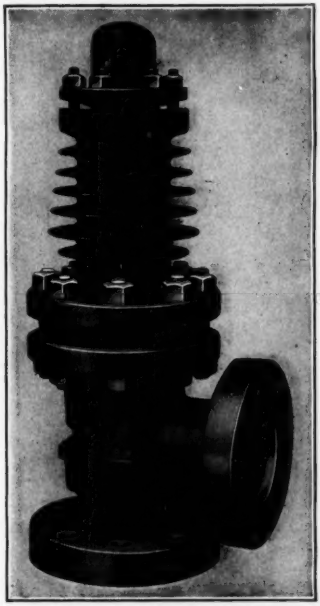

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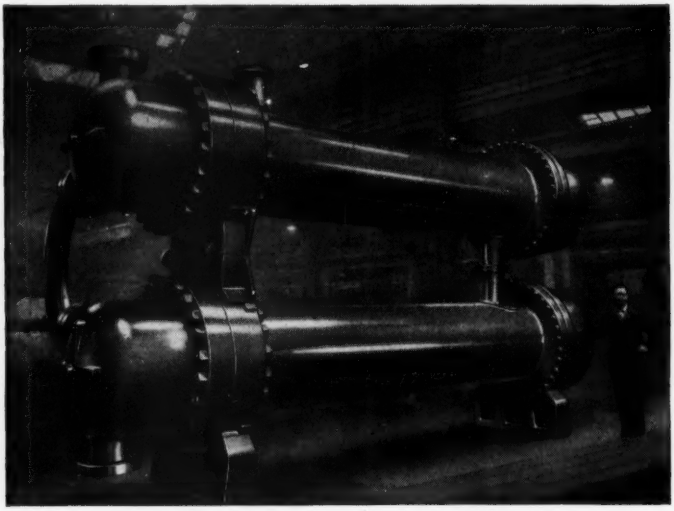

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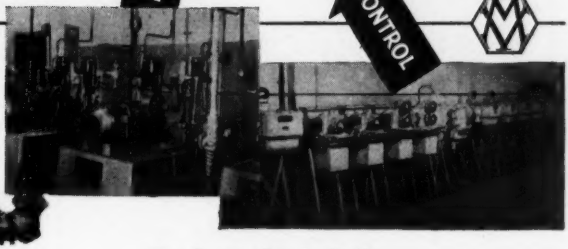

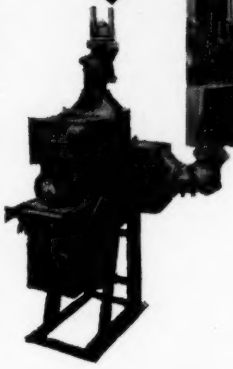

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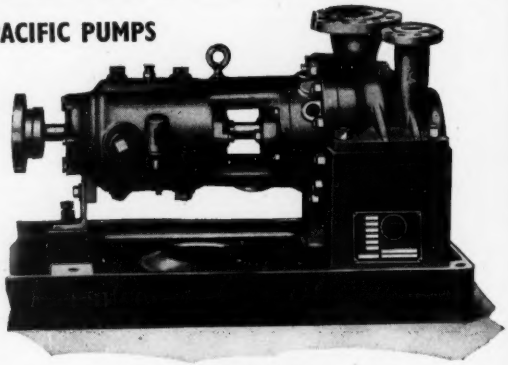

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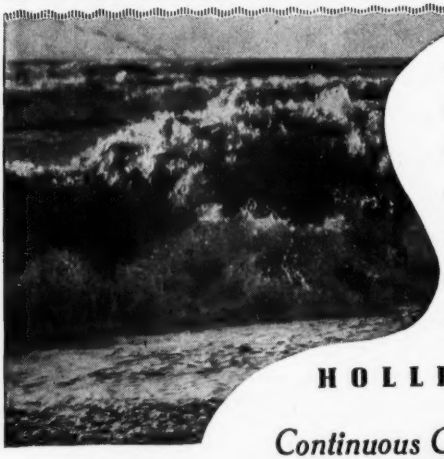

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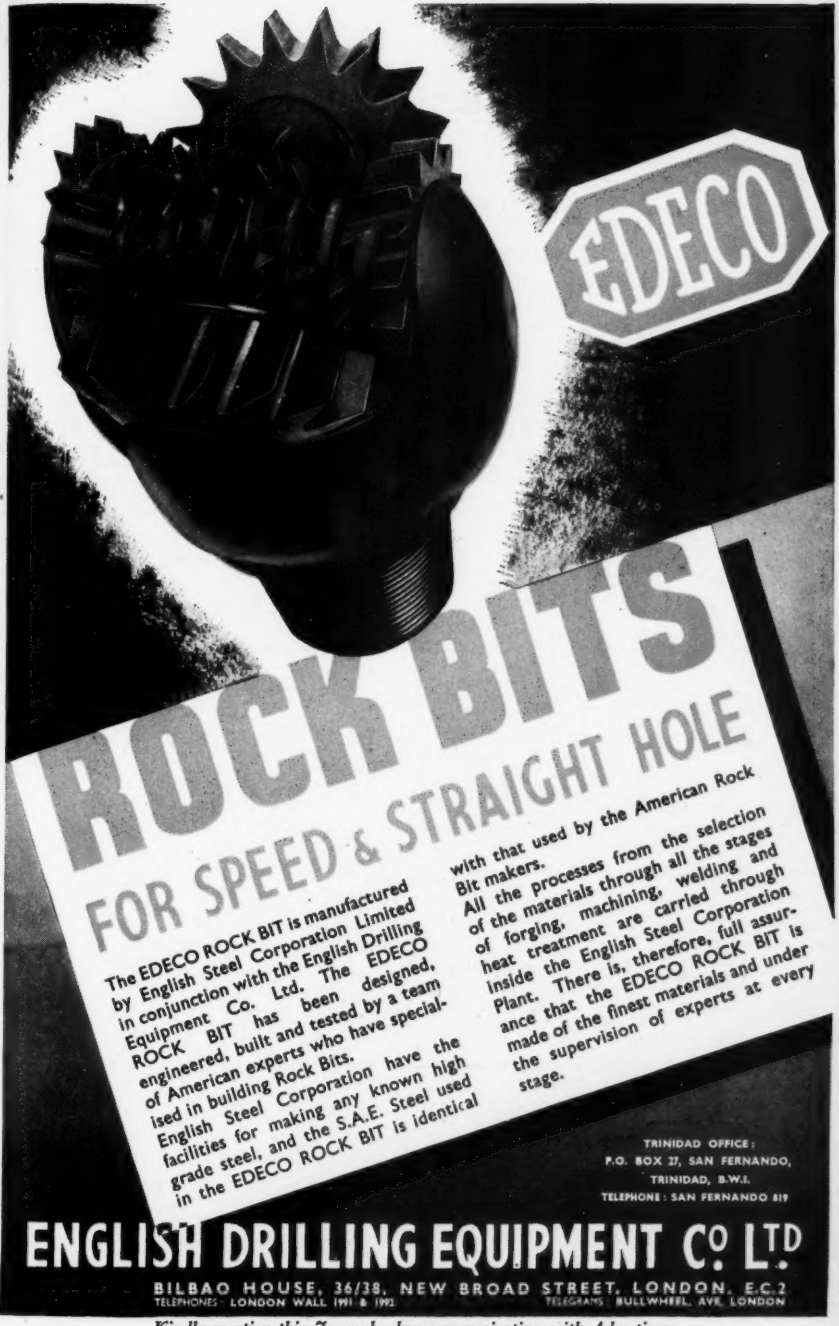
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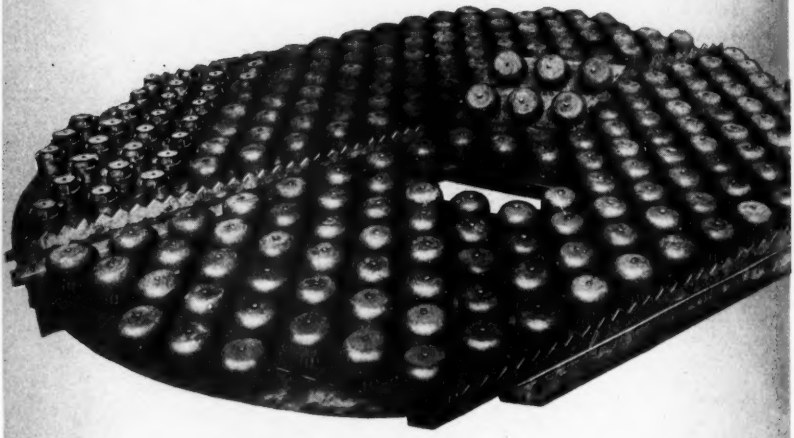

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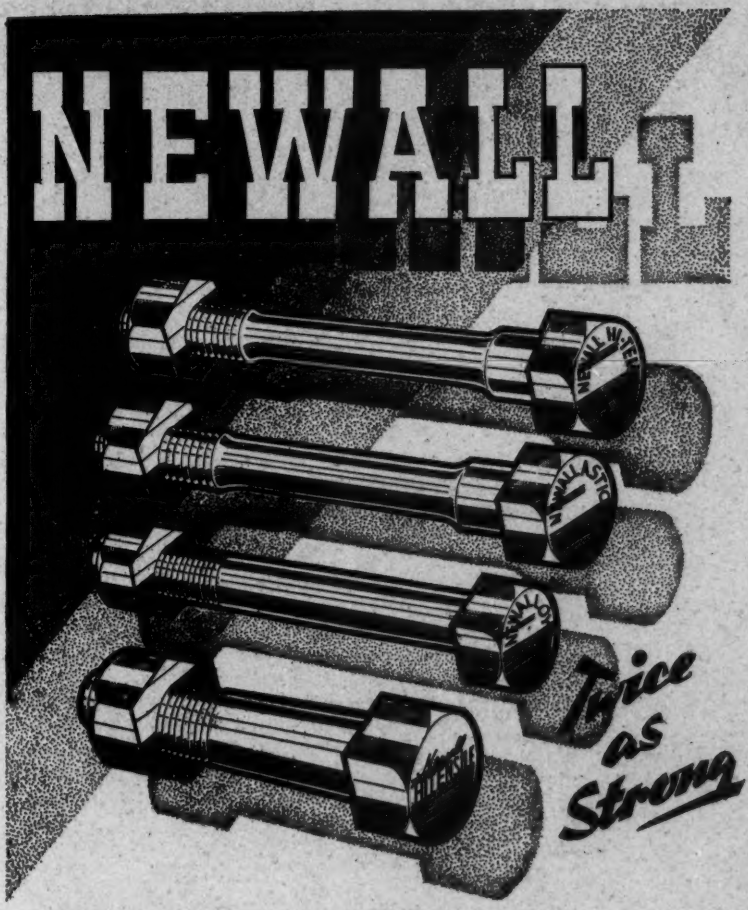

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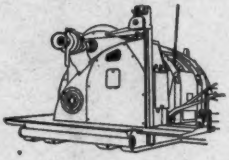

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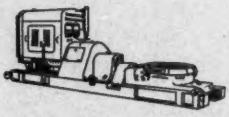

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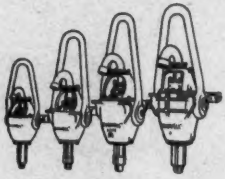

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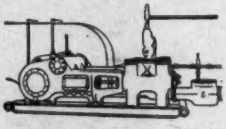

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